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STORY HOUR AT THE MOTHERCRAFT SCHOOL

There are two ways of training girls for motherhood: one is to put them in a class-room, with a text-book, and lecture at them; the other is to let them actually care for children of various ages, under careful supervision. The former method is that generally adopted nowadays, but the latter method, the only psychologically sound one, is that championed by the Mothercraft movement. (Frontispiece.)

MOTHERCRAFT

An Attempt to Make the Education of Girls Fit Their Requirements—Work Done in Private Schools—Should be a Part of the Public Schools—An Important and Immediately Practicable Phase of Constructive Eugenics

MARY L. READ

Educational Director, National Association for Mothercraft Education, New York, N. Y.

From Pennsylvania a young woman writes me:

"I am one of many girls whose training has fitted them for almost any position except the one of wife and mother. Since my marriage almost two years ago I have struggled daily to run the house economically and make up the deficiency in my early education. Now that the baby is coming I am facing a job for which I am even less prepared than for the other, and when I think that our baby's life may pay the forfeit for the mistakes I make in this direction, I am afraid of the future. Where can I find anything that will help me to learn how to take care of myself now and of the baby later? I shall be very grateful to you for anything you can give me."

The letter is only one of very many that I have received. What proportion of the young women in the educated and well-to-do class would express similar sentiments, if they were questioned? I venture to estimate somewhere near a majority.

The girls themselves are not to blame for this state of affairs; but someone is to blame.

It is one of the riddles of history why, when the life and welfare of children are of such vital concern to the family and the race, society has never taken the trouble to see to it that the women in whose charge these precious baby lives rested were highly trained and fittingly prepared for their responsibilities. Some people have even said it was not "nice" for young girls to think they would ever be mothers (although they knew they would and so did everyone else)—therefore it was not proper for them to be told about how to care for babies. Sometimes they were instructed in other housewifely arts; but when it came to the care of the child, the young mother usually has had to gain her experience at the expense of her own baby.

We are now beginning to see that such a state of affairs is criminal, and that the young girl needs education in what I have called Mothercraft, above everything else.

But I would emphasize at the outset that Mothercraft should be conceived as a much larger matter than merely instruction as to how one should treat a baby when it cries. It should include as much as possible of the knowledge essential to founding a family and carrying it along successfully. As a beginning, it should teach the girl a good deal about the qualities she should possess and that she should seek in the man she marries.

How unromantic! you say.

Not at all. There is no essential contradiction between romantic love and eugenics. A young woman knows a hundred young men, but is in love with only one (or possibly none) because the others do not embody the ideal that she has fashioned. Every young woman (and the same is true of men) has such an ideal, perhaps only vaguely defined but certainly felt, with which she is in love, for which she searches, and with which she sometimes invests an acquaintance only to discover later her illusion. This ideal is composed of the most alluring qualities and personalities she has known or read about.

EUGENICS AND LOVE

What normal young man would be likely to fall in love with a girl, however pretty, even charming, who he knew could be the mother only of

sickly, peevish, stupid children to inherit his name and perpetuate his family, or who would refuse to assume the burden of motherhood? What normal young woman would be attracted by any "fairy prince," however romantic, wealthy, handsome, if she were aware that his children would be doomed to early death, weakness or imbecility, and that she herself would be made a sufferer for life? The widespread tendency of young men and women of the present day to include eugenic qualities in this romantic ideal is itself sufficient evidence. Young men and women are generally too well balanced to marry simply from eugenic consideration without romantic love, although this is less reprehensible than marriage simply for title, livelihood, for social distinction, for personal creature comfort without consideration for either eugenics or romantic love.

It was with the most comprehensive idea of what such an education might possibly include, and the coining of a word which I hoped might define it to others, that I founded in New York City, in 1911, the School of Mothercraft. From the outset, the work was arranged for young women of at least high school education, and some of the students have been graduates of colleges or boarding schools.

The pedagogical principles on which I proceeded were those of my former teachers, John Dewey and G. Stanley Hall. Students must "learn to do by doing." Some visitors once expressed surprise and some disappointment because they said they had come expecting to see a school but what they found was a home. I considered this one of the greatest tributes they could have given the work. The school has always been conducted in a private residence, with resident students and a little group of resident children, ranging in age from a few months to seven years. Besides the resident students, many day students have come for special classes. The home conditions and spirit are carefully maintained.

In addition to their classes and recitations, students have several hours each day of practical work in the household and with the children. They learn their cooking by assisting in the preparation of meals and the cooking for the children. They learn how to do all the phases of household work by assisting the housekeeper, who is also the home economics teacher. Much attention is given to learning how to economize time and energy in doing the housework. The family budget is studied and they find out how to make the best use of a family income of $1,200 a year, with discussions, as well, of incomes down to $800 and up to $3,000 a year. They go to the shops and learn how to buy household furnishings and linens, and the clothing for little children. They learn how to market, going with the instructor to do the week's provisioning. One of the practical problems which they reach by the midyear is buying the food for the family, and providing a balanced diet, in variety of appetizing food, at $2.50 a week per person.

WORK WITH CHILDREN

But the most unique work is that with the children. At first the students simply live and play with the children, as members of the household, learning how to be with children and not do them harm—a lesson which few adults have ever learned. They observe the nursery "mother" as she cares for the physical needs of the children, and they participate in the group play with the kindergarten teacher. By degrees, as they learn the principles of child hygiene and psychology, they have practical experience, still under the supervision of instructors, in the daily physical care of the children at each age (including the baby), in story-telling, nursery games and songs, kindergarten handwork, nature-study. They learn how to take the important physical measurements of the children, the physical inspections that a nurse or physical education director would make, and how to study the disposition, mental traits and character of children.

Some of the students are preparing for their own home-making. Others are preparing for social work in settlements, day nurseries, orphanages, as

superintendents, investigators or teachers. These have special opportunity for observing all phases of social work in New York City and for acquiring practical experience in connection with some of the local institutions or societies.

Other students are preparing for the vocation of mothers' assistants or nursery governesses. This is a new vocational opening for educated young women in this country. Many parents now realize that a crude or immature girl, untrained and without either experience or judgment, is not a fit person to place in charge of a baby, or a little child at its most impressionable period in life. There is a large demand for trained mothers' assistants who are women of personality and education, but for lack of a training school few women have been prepared to fill these positions. The students preparing for this vocation have experience as part-time assistants, going by the day or the week to private families until they have had a wide range of such experience.

Before a student receives her certificate she must have demonstrated by actual work in the school that she can manage the household with efficiency, patience and economy; do any phase of the household work and put system and economy into that work; take the care of the baby or any of the children; make a personal study of a child and outline the program for its personal care and mental development; conduct the play and daily natural discipline of little children under home conditions; she must have accumulated a fund of child lore—rhymes and songs, plays, handwork, and stories that have been carefully selected for their fitness and educational value as well as their interest to little children.

To an outsider the curriculum of a mothercraft school suggests a selecting from the courses given in a number of different professional schools—kindergarten, home economics, physical education, nursing—brought together and taught in a home, from the home point of view.

Although there are still very few places in the United States where a young woman can get practical instruction in Mothercraft, yet parts of the work are being taken up by various agencies. Some of the State universities and some of the expensive and fashionable boarding schools are devoting special attention to home-making. Most girls' schools now offer some domestic science, but in most cases it is very brief, chiefly of a laboratory type, concerned with household mechanics, not concerned with practical or eugenic aspects. The hundred or more Little Mothers' Leagues in the New York City public schools are doing something in infant care for younger girls. There are a number of hospitals over the country where nursery maids are trained. Mothercraft is opposed to the training of crude nursery maids. Even the idea of training intelligent mothers' assistants is quite secondary to that of the training of future mothers. Such vocational training of educated young women is being done more widely in England and Germany than in the United States, many of the day nurseries abroad having educational departments.

Education in Mothercraft, however, is not a subject that should be left to private schools; it is an essential part of public education, and many prominent educational authorities have recognized this fact in principle, though school boards and trustees with the traditional ultra-conservatism of educational systems, are slow to put the idea into practice.

With a view to furthering the wider acceptance *and adoption* of this principle the National Association for Mothercraft Education is being formed, with headquarters in New York City. Its objects specifically are:

(*a*) To maintain a School of Mothercraft in or near New York City, providing for resident and non-resident students, extension classes, visiting instruction; having a kindergarten, resident nursery, public reference library.

(*b*) To develop branch schools of Mothercraft throughout the United States; and to conduct extension classes and institutes.

(*c*) To encourage similar education in homes, societies, schools and colleges.

(*d*) To hold conferences of its members and others interested.

(*e*) To educate public opinion by circulating literature, by meetings, by exhibits.

(*f*) To cooperate with institutions. organizations and individuals working toward the same general purpose.

Eugenicists have expressed hearty sympathy with the idea of Mothercraft education, appreciating that it is in large part a genuinely eugenic movement, and not a mere matter of euthenics; that it antedates and goes deeper than some phases of the "Save the Babies" movement, which in some quarters even disregards the interests of eugenics. Let us quote some of Galton's own words:

"Man is gifted with pity and other kindly feelings; he has also the power of preventing many kinds of suffering. I can conceive it to be within his power to replace Natural Selection by other processes that are more merciful and not less effective. This is precisely the aim of eugenics. Its first object is to check the birth rate of the unfit, instead of allowing them to come into being, though doomed in large numbers to perish prematurely. The second object is the improvement of the race by furthering the productivity of the most fit by early marriages and healthful rearing of their children. Natural Selection rests upon excessive production and wholesale destruction; eugenics in bringing into the world no more individuals than can be properly cared for and those only of the best stock."

Galton considered as a worthy eugenic measure the providing of a dowry for worthy young women, who in England in his day had limited prospects of marriage without such accessory. In our day and country this has no meaning. It is the adolescent girl, who in our country has almost unlimited freedom of choice as to whom she will marry—or whether she will marry at all— who holds the control of the future of the family and the race. It is she who controls the birth rate, infant mortality, the divorce rate, monogamy, polygamy or promiscuity, social welfare. According to her ideals, her foresight, her wise direction of instincts will society progress or deteriorate at its very foundations. Shall she be left to meet these responsibilities with only the guidance of impulse and naïvete, with the impression that to anticipate them seriously is unbecoming and abnormal? Naturally, she is not interested in technical essays, charts, diagrams, research reports, controversial discussions in genetics and social psychology and pathology. She will rarely appreciate her responsibilities through such channels until after her important decisions have been made—if ever. But there is for her a direct avenue. She instinctively loves little children and loves to be with them. Mothercraft education, with its intimate daily life with little children, is teaching eugenics in a language she can understand. From her training in the care and education of these little tots she eagerly comes with personal questions of eugenic import; she begins to realize that it is natural and normal for her to anticipate this phase of her future and to prepare herself for it; and she seriously develops her ideals for her own family.

Mothercraft education is constructive eugenics, based upon the maternal instinct inherent in every girl, pedagogically utilizing the nurturing, play, work and childlife interests of young womanhood. Truly, for these young women it is not learned theses, but a little child that shall lead them.

Infant Mortality Meeting

The next meeting of the American Association for the Study and Prevention of Infant Mortality will be held in Milwaukee, Wisconsin, October 19–21, 1916.

The section on Eugenics will hold no meeting. Prof. M. F. Guyer, of the University of Wisconsin, who is now chairman of the eugenics committee, is arranging a meeting for 1917.

CONSANGUINEOUS MARRIAGE

Subject Often Regarded by Unscientific Methods of Thought and Effects Misunderstood—Consanguinity in Itself Probably Has no Genetic Importance—The Hereditary Traits Are the Things To Be Considered—Marriage of Kin May Be Either Good or Bad in Effect

THE EDITOR

HOW often have we been told of those "isolated communities where consanguineous marriage has led to an appalling amount of defect and degeneracy!" Any one of us could name a dozen of these "horrible examples" offhand. Without questioning the facts, one may question the interpretation of the facts, and it seems to me that a wrong interpretation of such stories is partly responsible for the widespread and almost superstitious misunderstanding of consanguineous marriage at the present time.

The Bahama Islands furnish one of the stock cases, and Dr. W. C. Rucker has just put in my hands a copy of Dr. Clement A. Penrose's account of the situation there.[1] What the traveler says has a very familiar sound:

"In some of the white colonies where black blood has been excluded, and where, owing to their isolated positions, frequent intermarriage has taken place, as for instance at Spanish Wells, and Hopetown, much degeneracy is present, manifested by many abnormalities of mind and body. . . . I am strongly of the opinion that the deplorable state of degeneracy which we observed at Hopetown has been in a great measure, if not entirely, brought about by too close intermarrying of the inhabitants," and so on.

To demonstrate his point, he took the pains to compile a family tree of the most degenerate strains at Hopetown. There are fifty-five marriages represented, and the chart is overlaid with twenty-three red lines, each of which is said to represent an intermarriage. This looked like a good deal of consanguineous mating, but I thought I would test the matter a little further, so I started with the fraternity at the bottom of the chart—eight children, of whom five were idiots—and traced out their ancestry. In the second generation it ran to another island, and when the data gave out, at the fourth generation, I was a little surprised to find that there was not a single case of consanguineous marriage involved.

I picked out another fraternity consisting of two men, both idiots and congenitally blind, and a woman who had married and given birth to ten normal children. In the fourth generation this pedigree, which was far from complete, went out of the islands; as far as the data showed there was not a single case of consanguineous marriage. There was one case where a name was repeated, but the author had failed to mark this as a case of intermarriage, if it really was such. If we assume that it was a first-cousin marriage, yet almost any one of us may have one first-cousin marriage in the preceding four generations of his pedigree. I am unable to share the conviction of Dr. Penrose, that in the two pedigrees which I investigated, we have an example of the nefarious workings of intermarriage.

CONGENITAL BLINDNESS

Finally, I traced out a fraternity to which the author had called particular attention because three of its eleven members were born blind. The defect was described as "optic atrophy asso-

[1] Penrose, Clement A., "Sanitary Conditions in the Bahama Islands." Geographical Society of Baltimore, 1905.

ciated with a pigmentary retinitis and choryditis" and "this condition," Dr. Penrose assured us, "is one stated by the authorities to be due to the effects of consanguineous marriage."

Fortunately, the pedigree was fairly full and I was able to carry several lines of it through the sixth generation. There was, indeed, a considerable amount of consanguineous marriage involved. When I came to measure the amount of inbreeding represented by these blind boys, I was struck by the fact that it is almost identical with the amount represented by the present Kaiser of Germany.[2]

The coincidence seems to me eloquent.

I am unable to see in such a history as that of Hopetown, Bahama Islands, any evidence that consanguineous marriage necessarily results in degeneracy. It seems to me that Dr. Penrose himself points to a potent factor when he says of his chart, in another connection: "It will be noticed that only a few of the descendants of Widow Malone (the first settler at Hopetown) are indicated as having married. By this it is not meant that the others did not marry; many of them did, but they moved away and settled elsewhere, and in no way affected the future history of the settlement of Hopetown."

I have an idea that, by moving away, they did very decidedly affect the future history of Hopetown. Who are the emigrants? In most cases, probably the more enterprising and intelligent, the physically and mentally superior of the population, who rebelled at the limited opportunities of their little village, and went to seek a fortune in some broader field. The best went; the misfits, the defectives, stayed behind to propagate. Emigration in such a case has the same effect as war; it drains off the best stock and leaves the weaklings to stay home and propagate their kind. Under such conditions, defectives are bound to multiply, regardless of whether the marriages are consanguineous.

"It will be seen at a glance," Dr. Penrose writes, "that early in the history of the Malone family these indications of degeneracy were absent; but they began in the fourth generation and rapidly increased afterward until they culminated by the presence of five idiots in one family. The original stock was apparently excellent, but the present state of the descendants is deplorable."

Now three generations of emigration from a little community which even today has only 1,000 inhabitants, would naturally make quite a difference in the average quality of the population, eugenically speaking. In almost any population, a few defectives are constantly being produced. Take out the better individuals, and leave these defectives to multiply, and the amount of degeneracy in the population will increase, regardless of whether the defectives are marrying their cousins, or unrelated persons. The family of five idiots, cited by Penrose, is an excellent illustration, for it is *not* the result of consanguineous marriage—at least, not in a close enough degree to have appeared on the chart. It *is* doubtless a mating of like with like; and biologically that is all that consanguineous marriage is. Only, if two people are related by blood, they are more likely to carry the same hereditary traits than are two strangers. This is by no means always the case: if two inmates of an institution for the deaf, or the feeble-minded, or the epileptic, marry (they are doing it frequently, in most parts of the United States) it is perfectly obvious that they probably have the same inherited defect; while the chance that children with one of these defects would result from the marriages of first cousins, in whose family the defect was not previously known, is practically *nil*.

Honesty demands, therefore, that consanguineous marriage be not credited with results for which the consanguineous element is in no wise responsible; and the prevailing habit of picking out a community or a strain where consanguineous marriage and defects are *associated* and loudly declaring the one to be the *cause* of the other, is a perni-

[2] See von Gruber and Rüdin, Fortpflanzung, Vererbung, Rassenhygiene, p. 169. München, 1911.

cious evidence of the lack of scientific thought that exists almost everywhere.

Most of the studies of these isolated communities where intermarriage has taken place, illustrate the same point. Davenport, for example, quotes[3] an anonymous correspondent from the island of Bermuda which "shows the usual consequence of island life." He writes: "In some of the parishes (Somerset and Paget chiefly) there has been much intermarriage, not only with cousins but with double first cousins in several cases. Intermarriage has chiefly caused weakness of character leading to drink, not lack of brains or a certain amount of physical strength, but a very inert and lazy disposition."

It is difficult to believe that anyone who has lived in the tropics could have written this, except as a practical joke. Those of us who have lived in the warmer parts of the world know by observation if not by experience, that a "weakness of character leading to drink" and "an inert and lazy disposition" are by no means the prerogatives of the inbred. And in connection with the latter part of the indictment, the hookworm should not be forgotten.

If we are going to credit consanguineous marriage with these evil results, what are we going to do when evil results fail to follow?

What about Smith's Island, off the coast of Maryland, where all the inhabitants are said to be interrelated, and where a physician who lived in the community for three years failed to find among the 700 persons a single case of idiocy, insanity, epilepsy or congenital deafness?

What about the community of Batz, on the coast of France, where Voisin found five marriages of first cousins and thirty-one of second cousins, without a single case of mental defect, congenital deafness, albinism, retinitis pigmentosa or malformation? The population was 3,000, all of whom were said to be interrelated.

What about Cape Cod, whose natives are known throughout New England for their ability? "At a recent visit to the Congregational Sunday-School," says a student, "I noticed all officers, many teachers, organist, ex-superintendent, and pastor's wife all Dyers. A lady at Truro united in herself four quarters Dyer, father, mother and both grandmothers Dyers."

EXPERIENCE OF BREEDERS

And finally, what about the experience of livestock breeders? Not only has strict brother and sister mating—the closest inbreeding possible—been carried on for twenty or twenty-five generations, experimentally, without bad results, and even with good results; but the history of practically every breed shows that inbreeding is largely responsible for its excellence.

Dr. Penrose adopts a common attitude toward these facts. "I cannot conclude from them that close and continued intermarriage among human beings is unattended with evil results," he informs us, "for we can never be certain that the same conditions are followed in the reproduction of the human species as are enforced in the breeding of animals. The organization of the human being is so complex, and the nervous system so delicately balanced, that it is difficult, if not absolutely impossible, to establish a human type, and to agree as to what constitutes good human stock. Nothing is more difficult than to find a perfectly normal man or woman, and if we cannot agree as to what constitutes a normal type, how are we to decide as to what constitutes an abnormality? In a sense, a genius is as abnormal on one hand as an idiot on the other, and it is impossible to draw a line between a being with normal mental capacity and one which is slightly below the standard."

What does all that mean, in connection with the marriage of kin? Precisely nothing.

Consanguineous marriage will doubtless continue, for many years, to exist in a fog of superstition, but the time is past, it seems to me, when any one can question the facts from the genetic point of view. If we know anything

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[3] Davenport, Charles B., "Heredity in Relation to Eugenics," pp. 184 ff. New York, 1911.

about heredity, we know that consanguineous marriage, being the mating of like with like, intensifies the inheritance of the offspring, which gets a "double dose" of any trait which both parents have in common. If the traits are good, it will be an advantage to the offspring to have a double dose of them; if the traits are bad, it will be a disadvantage. The marriage of superior kin should produce children better than the parents; the marriage of inferior kin should produce children even worse than their parents.

In passing judgment on a proposed match, therefore, the question to be asked is not, "Are they related by blood?", but "Are they carriers of desirable traits?" That is, perhaps, a rather cold-blooded way to put it, but once in a while, at least, a marriage *is* regarded in a cold-blooded, genetic light, as the number of letters to me, asking advice about consanguineous marriage, abundantly proves.

The nature of the traits can be told only by a study of the ancestry. Of course, characters may be latent or recessive for many generations, but this is also the case in the population at large, where the chance of unpleasant results is so small that it would be foolish to weigh it. If the same congenital defect or undesirable trait does not appear in the previous three generations (including collaterals) of two cousins I know of nothing in genetics which would discourage them from marrying if they want to.

The Inheritance of Emotional Control

THE DACK FAMILY, a Study in Hereditary Lack of Emotional Control. By Mrs. Anna Wendt Finlayson, Field Worker of Warren State Hospital, Warren, Pa. Preface by Charles B. Davenport. Eugenics Record Office, Bulletin No. 15. Pp. 46, price 15 cents. Cold Spring Harbor, Long Island, N. Y., May, 1916.

This study of several hundred related individuals, covering three generations, in the mountains of Pennsylvania, describes another large group of socially worthless people, the descendants of two Irish immigrants. The stock is characterized by "restlessness, quarrelsomeness, loquacity, abuse, pugnacity, intermittent outbursts of violent temper, and sex offense," as well as laziness, mental dullness, alcoholism, and the other usual marks of a degenerate strain. The preface tells us that "the present study is of especial value since it illustrates again the fact that the aberrant behavior of each family group is stamped with its peculiar characteristics; because into each a unique combination of hereditary elements has entered." This may be true, but the present study offers no proof, since no systematic attempt is made to allow for the influence of the environment, and no adequate evidence is offered that the various emotional traits described are in reality due to inheritance. But although the study may add nothing to our knowledge of heredity, it is useful sociologically as picturing a kind of family stock which is costly to the race, and unfortunately all too numerous in some parts of the United States.

Eugenics Education in St. Louis

The St. Louis Eugenics Educational Society now has nearly two score members, according to a letter from the secretary, C. R. Paine. The scope of the organization is much broader than the term "eugenics" ordinarily includes, embracing as much environmental influence as inheritance. "We feel," Mr. Paine writes, "that the present eugenic thought is not only very academic but quite chaotic in its ordering; not having as yet found a clear base-line for thinking, systemizing and methodizing. Consequently the present thought is very impersonal; seeking more after negative factors than positive ones; more after heredity than environmental-social influences; law than education in its broad popular sense; statistics than life."

INHERITANCE OF BALDNESS

Various Patterns Due to Heredity and Sometimes Present at Birth—A Sex-limited Character—Dominant in Man—Women Not Bald Unless They Inherit Tendency from Both Parents[1]

DOROTHY OSBORN

Ohio State University, Columbus, Ohio

THERE are several distinct patterns of baldness. They vary in extent from the small spot, not uncommon, to entire baldness which is exceptional. Among the most common patterns are complete baldness on the top of the head, that involving only the crown, that giving the appearance of an extremely high forehead, and that covering the top and back of the head. The hair associated with baldness may be thin, normal or heavy.

Many theories have been advanced as to the cause of baldness. Some of these are diseases of the scalp, ill health, pressure of tight hatbands on the scalp, and heredity. Recently an article appeared in a popular magazine declaring that baldness is entirely due to the indiscriminate wearing of hats, not necessarily tight. Not baldness itself, but the shape of the head is inherited and in wearing hats the consequent pressure on the blood vessels nourishing the scalp causes the loss of hair. The main argument in support of this theory was that women never become bald.

In collecting data for this paper all types of hair were recorded as thin, normal or heavy. Questions were also asked as to how long heavy hair was retained, the pattern and time of appearance of baldness if present, the kind of hat worn, and what was used to prevent baldness. The results show that baldness is undoubtedly hereditary.

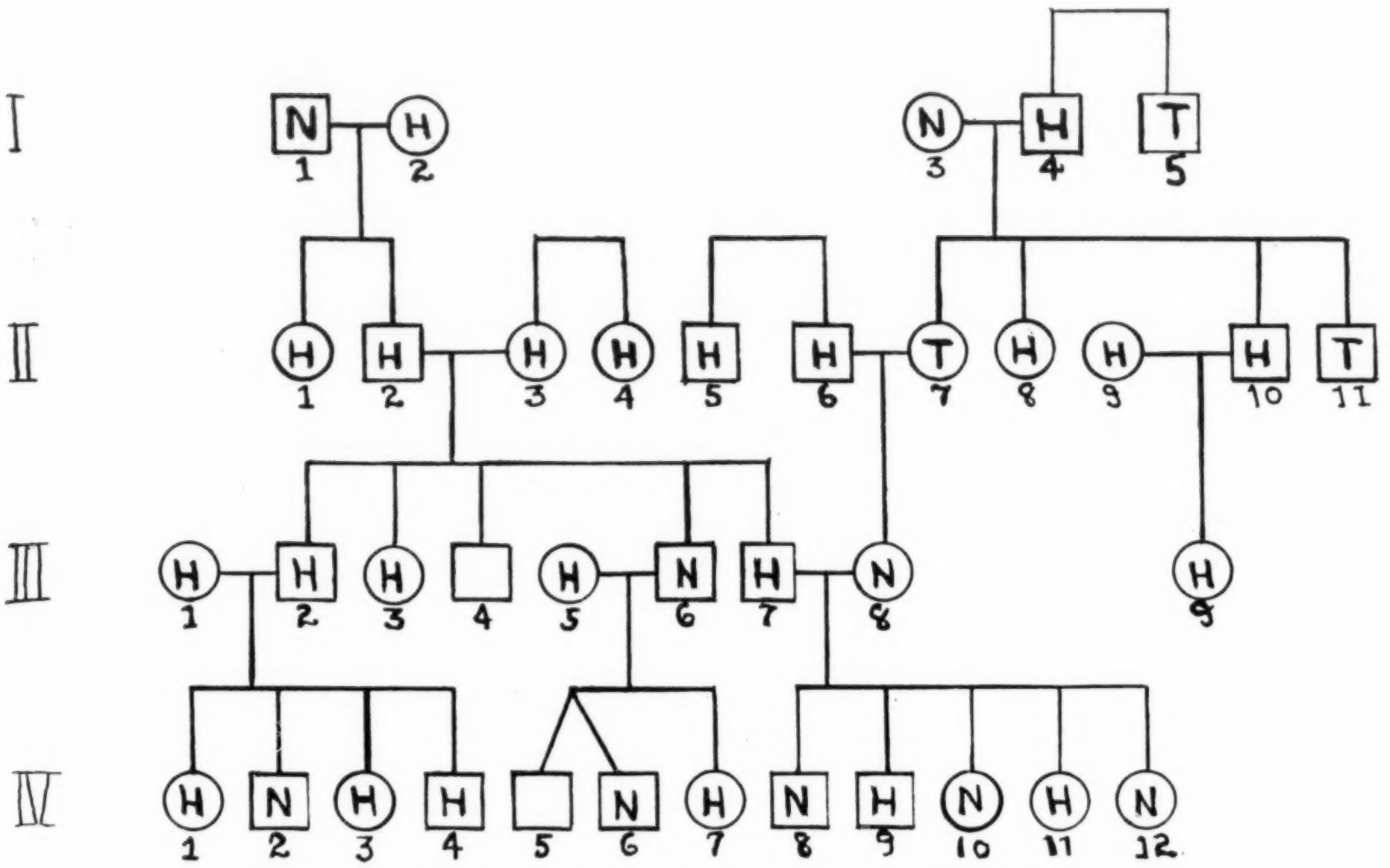
Two families with exceptionally heavy hair were traced, and no baldness could be found in either one. Ordinary tight hats had been worn by the men, which had not affected the persistence of the hair. In case the hair was exceptionally heavy in youth more than a normal amount was retained to an advanced age.

NO BALDNESS HERE

A head of thick, fine hair, at the age of 33. Father of this subject is now 61 years old with abundant hair. Both father and son wear tight hats. There is no baldness in the family history. (Fig. 1.)

In the first chart, III 3 had very poor health, but until her death at thirty-five her hair was always remarkably heavy. Ill health had had no noticeable effect. Her niece, IV 12, now twenty years old, who originally

[1] Contribution No. 48 from the Department of Zoology and Entomology, O. S. U. This work was done in a course in genetics under the direction of Prof. William M. Barrows.



A FAMILY IN WHICH NO BALDNESS HAS APPEARED (Chart 1)

Squares represent males and circles females; solid black symbols (used in subsequent charts, but not in this one) indicate baldness. H=heavy hair, N=a normal amount, T=thin hair, ? indicates uncertainty as to baldness, due to lack of information. Particulars as to the individuals on the above chart follow:

Generation I. I 1 had at least a normal amount of hair, and it may have been heavy. I 2 had heavy hair, and many members of her family had exceptionally heavy hair. I 3 had at least a normal amount of hair, and I 4 probably heavy. I 5 had thin hair.

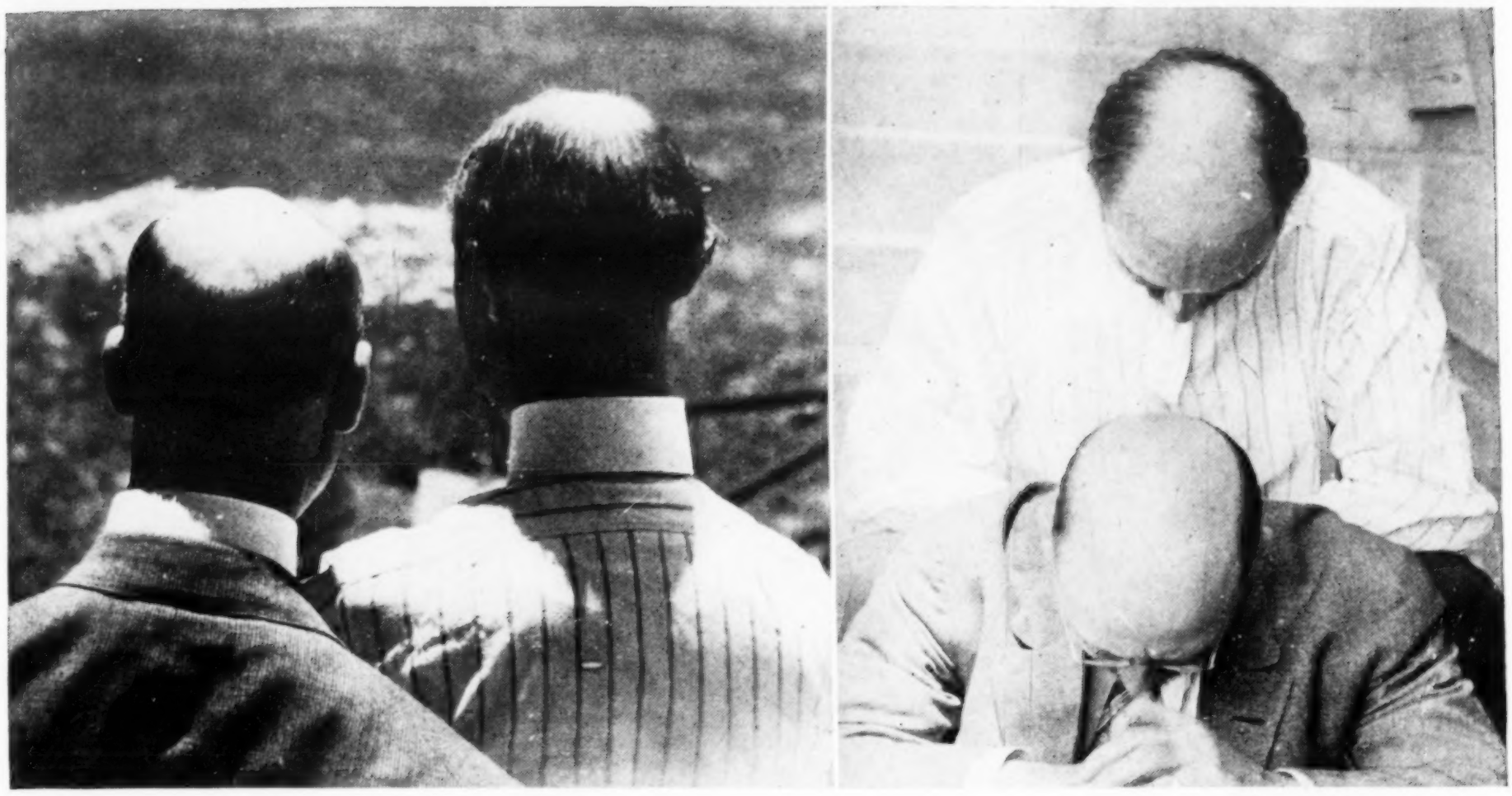
Generation II. II 1, II 2, II 3, II 4, II 5, and II 6 had heavy hair, and retained same throughout life. II 7 has thin hair, is now eighty-nine, and retains her normal amount of hair. II 8, II 9, and II 10 had heavy hair. II 11 had thin hair.

Generation III. III 1 had heavy hair. III 2 has very heavy hair. III 2 had very heavy hair, and although in poor health for a number of years, retained it until her death at thirty-five. III 4 died at the age of thirteen which makes data doubtful. III 5 and III 6 both have heavy hair. III 7 has exceptionally heavy hair and retains same at sixty years of age. III 8 has about normal hair. III 9 had heavy hair.

Generation IV. IV 1, IV 3, and IV 4 have very heavy hair. IV 2 has not much more than a normal amount. IV 5 died in infancy. IV 6 has not much more than a normal amount. IV 7 has exceptionally heavy hair. IV 8 has about the normal amount. IV 9 has extremely heavy hair, very similar to his father's. IV 10 has slightly less than normal. IV 11 has very heavy hair, and IV 12 has less than a normal amount, due to illness. (Fig. 2.)

had a normal amount of hair, has lost much through poor health. In the other family studied, one man, now sixty, has been in very poor health for a number of years, but there has been no noticeable effect on his hair, which is very heavy and coarse.

Returning to chart 1, II 7 and I 5 both had very thin fine hair, but retained it until very late in life. I 5 died at ninety-three and II 7 is now eighty-nine. Her husband, II 6, had heavy coarse hair and their daughter, III 8, has a normal amount of moderately fine hair. The husband of III 8, now sixty, has exceptionally heavy coarse hair, common in his family. The children of this mating show an interesting variety of amounts and textures of hair. IV 8 has a normal amount of moderately fine hair; IV 9 has exceptionally heavy, coarse hair like his father's; IV 10 has not quite a normal amount of moderately coarse hair; IV 11 has very heavy, fine hair, and IV 12 has rather thin fine hair.



TWO CASES OF PATTERN-BALDNESS

The same individuals are shown in each picture. The man at the right (upper, in the second picture) had heavy, coarse, curly hair until twenty years ago, when he began to lose it very gradually. His father had the same pattern of baldness; his mother's family had thin hair but no baldness. The lower individual has thin, straight hair; baldness appeared at the age of 19, and his son developed the same pattern at the same age. The maternal grandmother of the man here shown was bald. (Fig. 3.)

From the two families traced definite conclusions cannot be drawn as to the inheritance of the amount of hair. Number of individual hairs and textures are probably inherited separately, the appearance of amount being dependant on both.

The families which were traced in reference to baldness show that it is inherited as a sex-limited trait. It is dominant in men, is inherited directly from father or mother to son, but is recessive in women. Apparently a duplex condition in women is necessary to bring it out. This is the same condition that Thos. R. Arkell found in the inheritance of horns in sheep.[2]

Partial baldness sometimes occurs in women in case there is illness in addition to a simplex inheritance. Where there is not the tendency to baldness the hair is slightly affected by poor health and sometimes falls out, but is regained upon the recovery of good health. Moreover, as has already been stated, some individuals in very poor health do not lose any hair.

In one family, unfortunately not charted, the father became very bald before he was thirty. His only son showed the exact pattern of his father's baldness at birth. The only hair on the head was in a fringe above the ears and at the back. Later hair came in on the top of the head, presenting a normal appearance. The boy is now nineteen years old and is beginning to lose hair above the forehead. This seems to indicate that the pattern is present at birth.

Congenital baldness must not be confused with pattern baldness. In the former there is no hair whatever, eyebrows are lacking and nails are poor or faulty. Instead of hair there is sometimes a downy fuzz. One family observed has shown this trait for the three generations about which anything is definitely known. The grandfather, father and mother were completely bald from birth. The seven sons and one daughter have never had any hair. The only grandchild, son of the oldest boy, also shows the same peculiar trait

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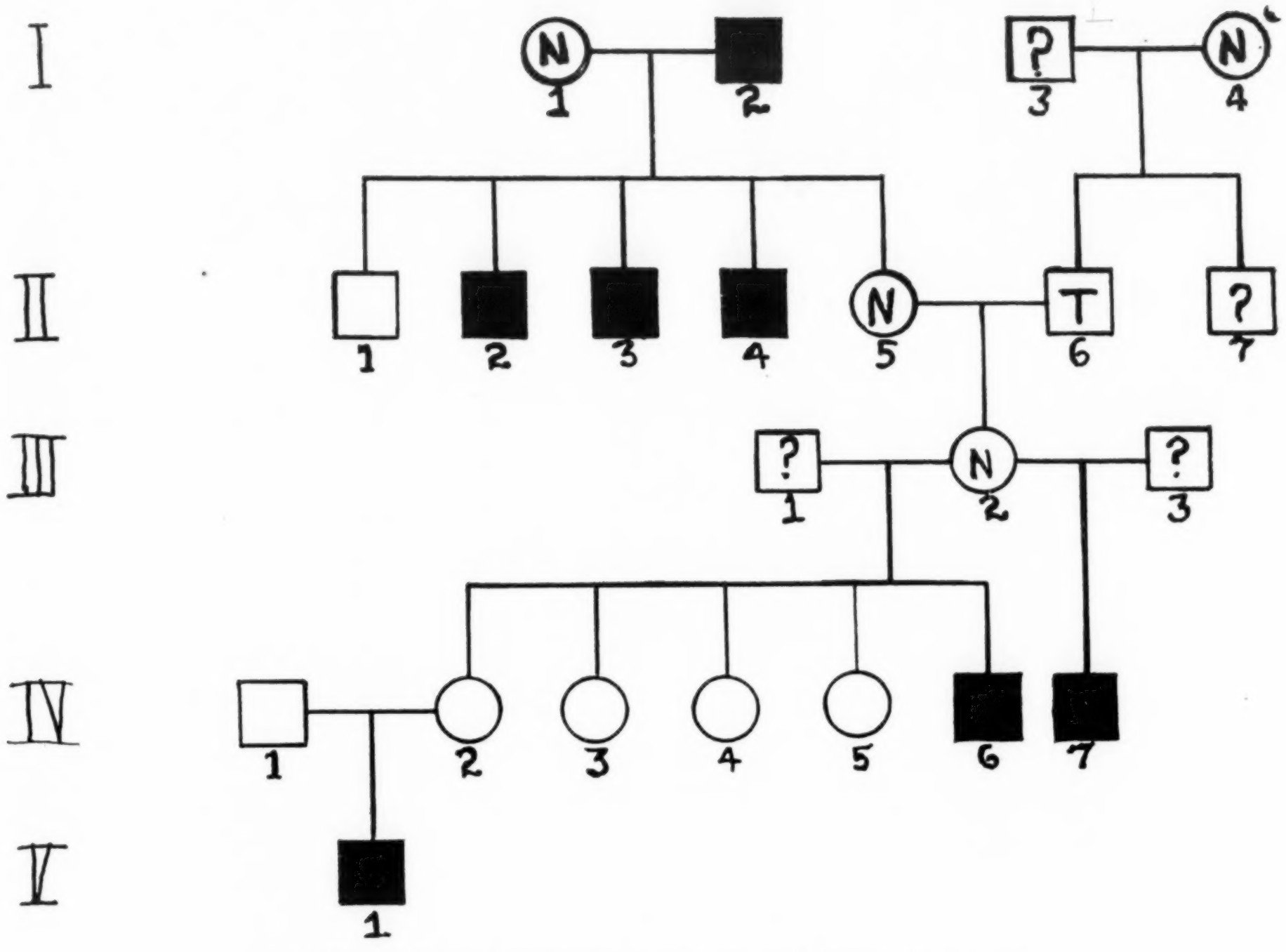
[2] Arkell, T. R. "Some Data on the Inheritance of Horns in Sheep." New Hampshire Agricultural Experiment Station, Bull. 160, May, 1912.



BALDNESS PASSED THROUGH WOMEN (Chart 2)

Symbols the same as in the preceding chart.

Generation I. I 1 had a normal amount of hair. I 2 was very bald but at what age is unknown. I 3 is questionable. I 4 had a normal amount.

Generation II. II 1 was not bald but amount of hair is unknown. II 2, II 3 and II 4 were all very bald but age of appearance is unknown. II 5 had a normal amount of hair. II 6 had thin hair. II 7 is questionable.

Generation III. III 1 is questionable. II 2 had a normal amount of hair but was undoubtedly a carrier, inheriting the trait from her mother who was also a carrier. III 3 is questionable.

Generation IV. IV 1 never became bald and had at least a normal amount of hair. IV 2 now past middle age, is a carrier but has never shown the trait herself. Her sisters, IV 3, IV 4 and IV 5, have never shown any signs of baldness. IV 6 was very bald. IV 7, a half brother, was also very bald.

Generation V. V 1 became very bald between the ages of twenty-five and thirty. (Fig. 4.)

of his father's family. In all of these cases the nails were abnormal.

Charts 2, 3, 4 and 5 illustrate clearly the general laws of the inheritance of pattern baldness. Chart 2 is presented to show that in case a woman inherits the simplex condition she does not become bald herself, but transmits baldness, in the long run, to one-half of her sons and also the possibility of transmission to one-half of her daughters. A bald man with a simplex inheritance transmits in the same way. I 1 had a normal amount of hair, but may have been a carrier. I 2 was bald. Three out of four sons of this mating, II 2, II 3, and II 4, were all bald, and the only daughter, II 5, was probably a carrier. Her husband, II 6, was never bald. The daughter of this couple, III 2, inherited the trait from her mother and transmitted it to two sons, IV 6 and IV 7, and, at least, one daughter, IV 2. She was married twice but as nothing is known in reference to the hair of either husband, and moreover, as a son by each marriage was bald, it was concluded that the trait was inherited through her. IV 1 was never bald, so could not transmit baldness. IV 2 must be a carrier, transmitting the trait to her son, V 1.

In chart 3 the trait is inherited for four generations, directly from father to son. II 5 became very bald at forty, as did both of his sons, III 5 and III 6, and also his grandson, IV 4. In the families charted, where the inheritance is direct from father to son, the pattern and age of appearance vary slightly in succeeding generations. In this case in chart 3 baldness covers the entire top of the head and extends down almost to the neck. The hair is lost at about forty years of age. II 8 inherited baldness from his father, I 2, but accurate information could not be secured. IV 1, a woman, has a bald spot at the back of her head. Her father, III 4, was bald and her mother, III 3, was a carrier, inheriting the trait from her father, II 1. The daughter, IV 1, inherits a duplex condition, as both parents transmit the trait. Neither of her sisters, IV 2 and IV 3, is bald. The expectation of baldness in the daughters from a mating of this description would be one in four.

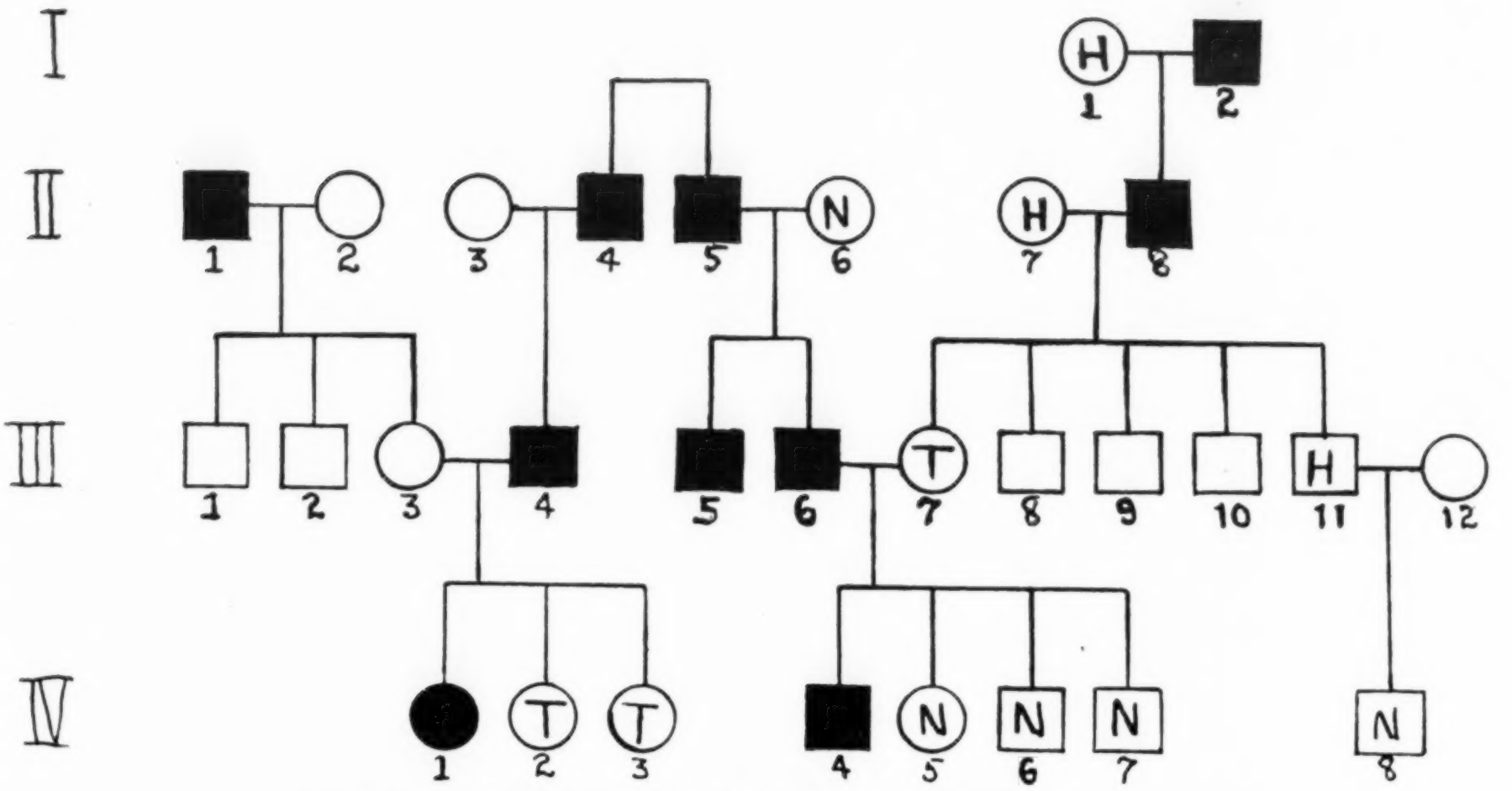
Chart 4 shows many interesting conditions. I 2 became bald at rather an early age and had quite an extensive pattern. Her four sons, II 3 and II 4, by the first, and II 6 and II 8, by the second marriage, were all bald. Unfortunately little is known of the first two, but the two latter showed the same pattern as their mother. Having all of her sons bald would indicate that she herself was homozygous for the trait. In the families studied this holds good for two of the other three bald women, who married and had sons. The fourth bald woman, not charted, had typhoid fever when she was forty and afterwards lost the hair on the front of her head. Her father was bald. Five of her nine sons were certainly bald, two are questionable, and two were not. This is a case of baldness in a woman caused by ill health in addition to an inherited tendency. Returning to chart 4, II 5 was bald, inheriting only the simplex condition, but upon inquiry it was ascertained that she had poor health all of her life and did not become bald until rather late. Her sister, II 9, may also have been bald, but data concerning her are too uncertain to put her down as such. Her two sons, III 15 and III 16, were both bald. II 2 must be a carrier, as one son, III 9, is bald and one daughter, III 3, is a carrier, transmitting the trait to one son, IV 2. III 9 is bald and III 10 is a carrier, as is shown by the amount of baldness in their children.

HIS BROTHERS ARE BALD

This individual, age 31, has a heavy head of coarse hair. His two younger brothers are bald—one at the age of 22. His father is bald but his mother's family showed no baldness. The individual here shown evidently did not inherit the bald pattern, and therefore retains his hair in spite of the fact that he has had typhoid fever and other illness, and therefore has had every chance to express the inheritance if he had it. Obviously, baldness is a segregating character which may go to some of a family, but not to all unless it comes from both sides of the ancestry. (Fig. 5.)

Four sons, IV 8, IV 9, IV 12, and IV 13, are all bald. The other two sons, IV 14 and IV 15, are still too young to show whether they have inherited the trait or not. A daughter, IV 10, has recently become bald. She inherits the duplex condition because both of her parents transmit the trait. Another daughter, IV 11, shows no signs of baldness.

In chart 5 there is shown an unusual number of bald women. I 1 was completely bald; I 2 is questionable; II 2 was partly bald; while II 3 and II 4 were completely bald. II 1, husband



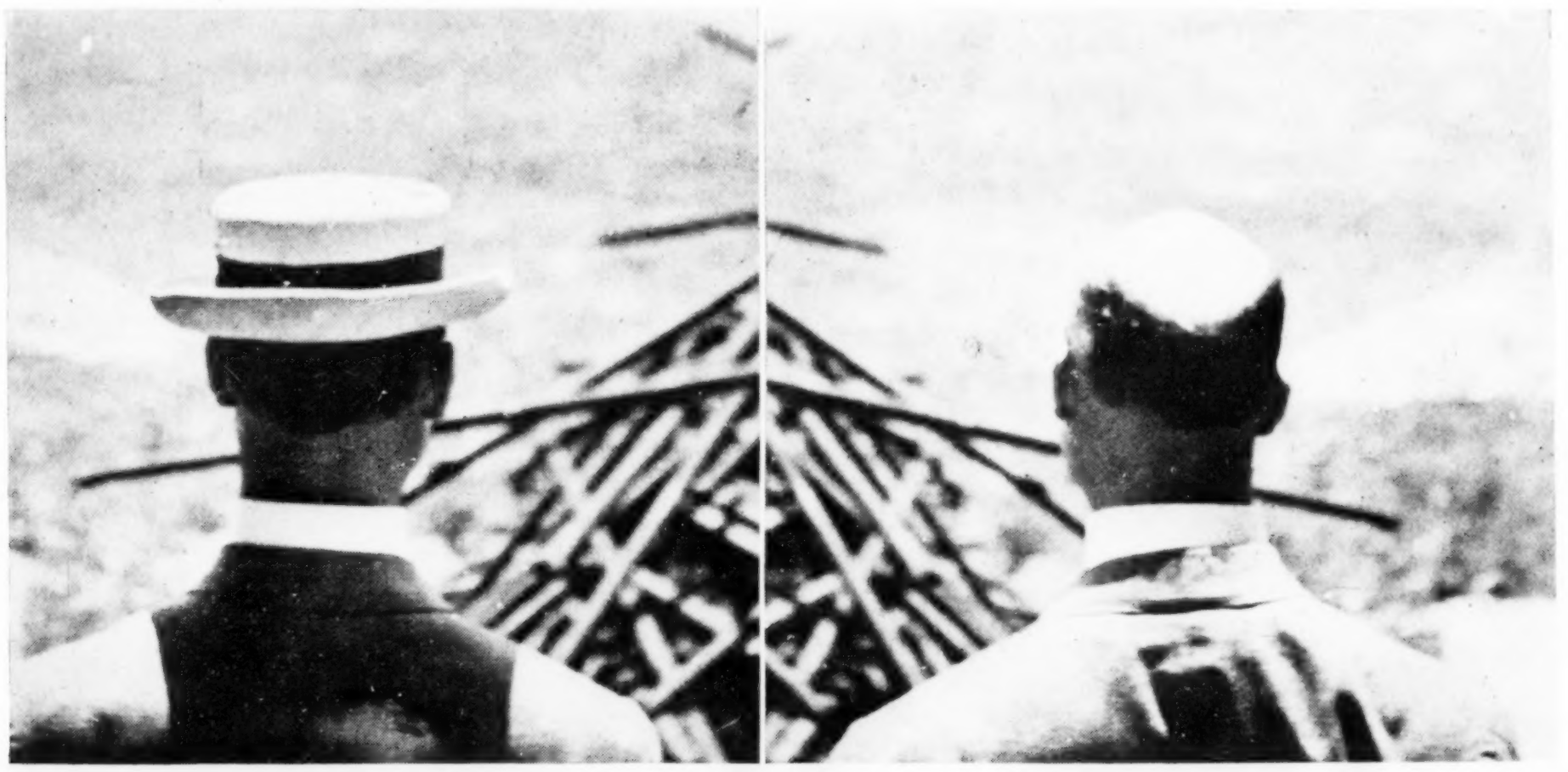
A TYPICAL CHART OF FAMILY BALDNESS (Chart 3)

Generation I. I 1 had heavy hair. I 2 was bald.

Generation II. II 1 was bald. II 2 is unknown. II 3 is also unknown. II 4 was bald. II 5 became very bald at forty. II 6 was not bald but her family history is unknown. II 7 had heavy hair. II 8 was bald.

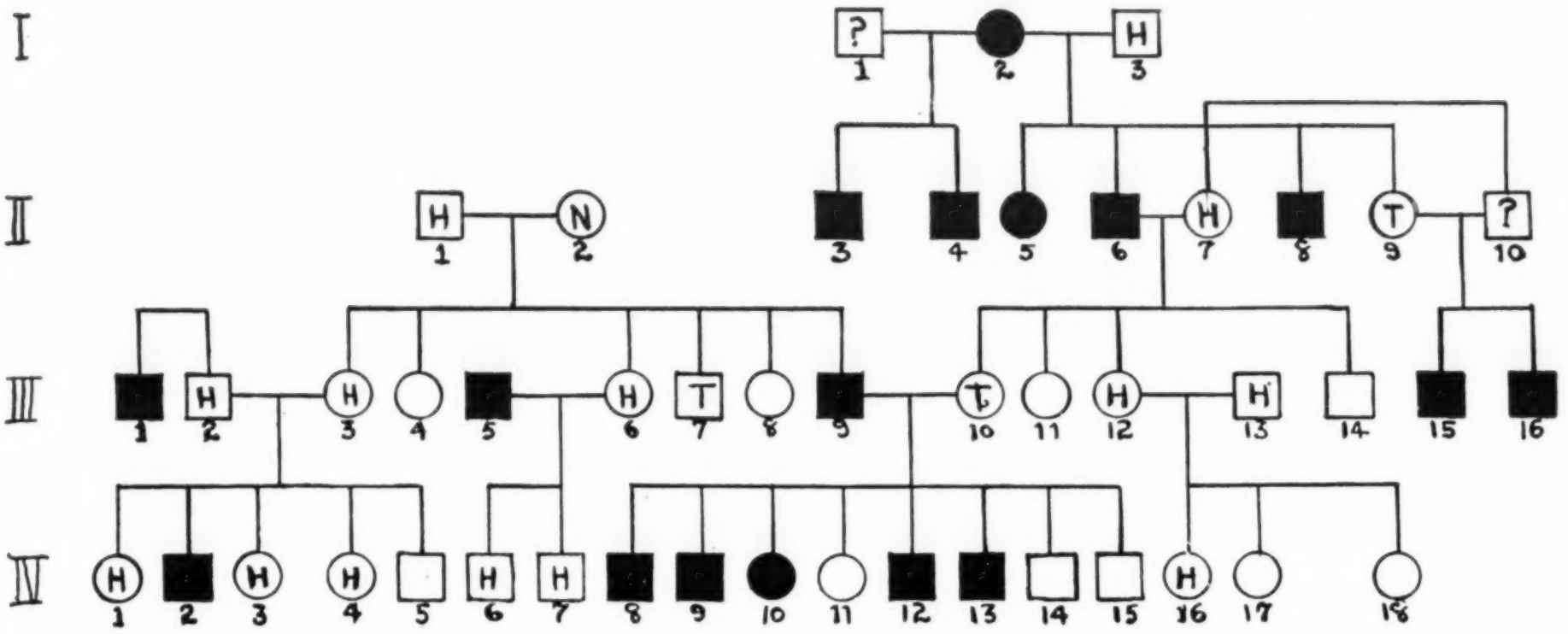
Generation III. III 1 and III 2 died in infancy. III 3 was not bald herself but was a carrier. III 4 was bald. III 5 and III 6 both became bald at forty, showing the same pattern as their father. III 7 had thin hair. III 8, III 9 and III 10 are questionable. III 11 has heavy hair. III 12 is not known.

Generation IV. IV 1 has a bald spot at the back of her head. IV 2 and IV 3 both have very thin hair. IV 4 became very bald at forty, having the same pattern as his father. IV 5, IV 6 and IV 7 all have a normal amount of hair. IV 8 has a normal amount of hair. (Fig. 6.)



THE HAT IS NOT TO BLAME

Two views of the same individual, showing that the bald pattern is *above* the point where the hat binds the scalp. If baldness were due to the hat, it would be expected to begin at the line where the hat binds the head and, according to theory, cuts off the supply of blood. As a fact, the baldness is distinctly a matter of inheritance; it may appear in families where tight hats are worn; and on the other hand no amount of hat-pressure will cause it to appear in families where the hereditary determiners are not present. (Fig. 7.)



INHERITANCE OF PATTERN BALDNESS (Chart 4)

Generation I. I 1 is questionable. I 2 was very bald on the top and front of the head. I 3 had heavy hair and retained same to an advanced age.

Generation II. II 1 had heavy hair. II 2 had normal hair but was probably a carrier. II 3 and II 4 were both bald. II 5 had very poor health and was much older than the other members of her family when baldness first appeared. II 6 and II 8 were twenty-five when they first became bald and show the same pattern as their mother. II 7 had heavy hair. II 9 had very thin hair and it is thought that later in life she became bald but nothing definite concerning it is known. II 10 is questionable.

Generation III. III 1 was bald. III 2 and III 3 had heavy hair. III 4 is not known. III 5 was bald. III 6 had heavy hair. III 7 had thin hair. Nothing in reference to the hair is known about III 8. III 9 is slightly bald. III 10 has very thin hair and is evidently a carrier. III 11 died at an early age, as did also III 14. III 12 and III 13 had heavy hair. III 15 and III 16 both were very bald and probably became so at the same age as their uncles.

Generation IV. IV 1 had heavy hair as did also IV 3 and IV 4. IV 2 was bald. IV 5 was not bald but the amount of hair is unknown. IV 6 and IV 7 had heavy hair. IV 8, IV 9, IV 12 and IV 13 all became bald at about twenty-five and show the same pattern as the maternal great-grandmother. IV 10 has recently become bald, the cause assigned being illness, but the real cause is probably heredity. Both IV 14 and IV 15 are still under twenty years of age. IV 16, IV 17 and IV 18 all have heavy hair. (Fig. 8.)

TABLE I.—*Inheritance in Men*

Matings	No. matings	Sons	No. bald		No. not bald.	
			Expectation	Actual	Expectation	Actual
BB×Bb....	2	3	3	3	0	0
BB×bb.....	5	13	13	12 1?	0	0
Bb×Bb.....	4	16	12	10 2?	4	4
Bb×bb.....	49	108	54	64	54	44
bb×bb.....	24	43	0	0	43	43

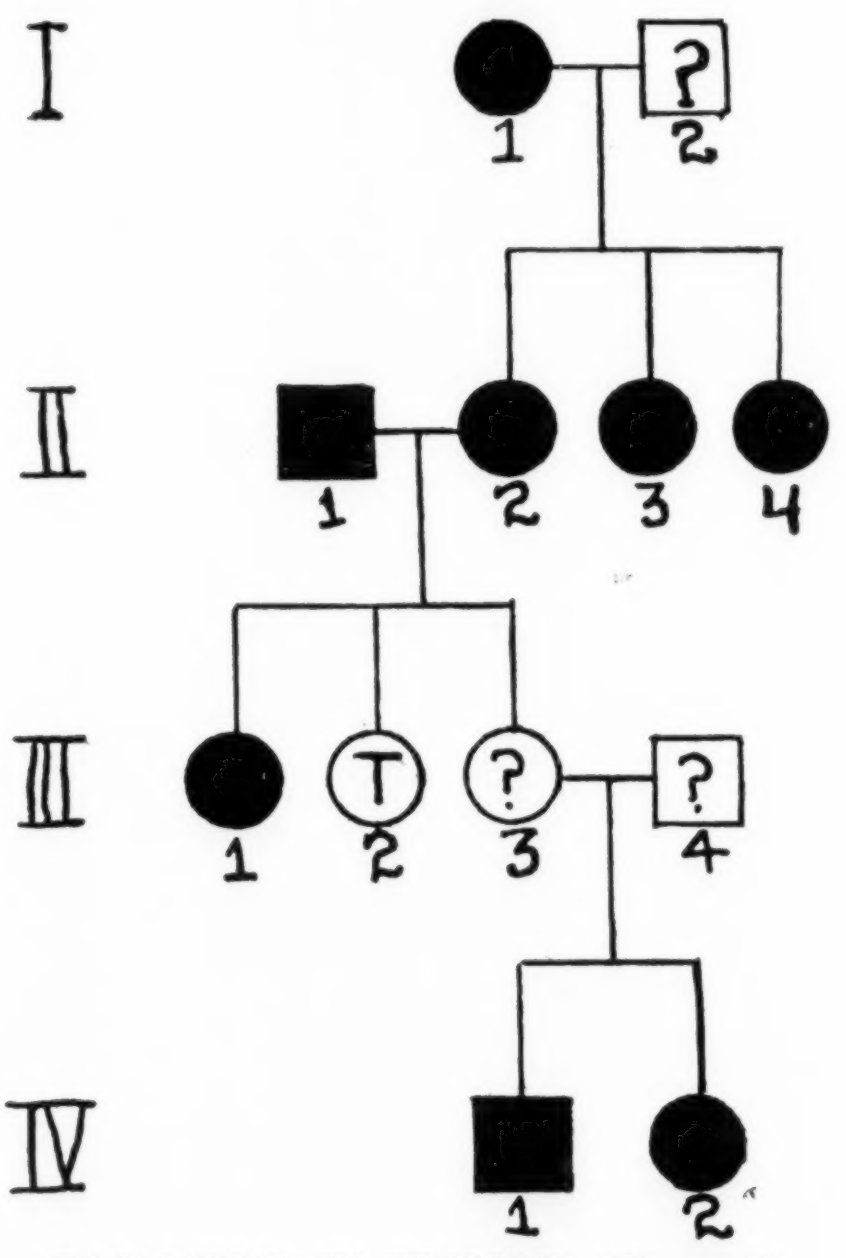
Inheritance in Women

Matings	No. matings	Girls	No. bald		No. not bald	
			Expectation	Actual	Expectation	Actual
BB×Bb....	2	5	2.5	2 1?	2.5	2
BB×bb.....	5	8	0	1 1?	8	6
Bb×Bb.....	4	9	2.25	2	6.75	7
Bb×bb.....	49	59	0	0	59	59
bb×bb.....	24	54	0	0	54	54

B indicates the presence of baldness, and b the absence of it.

Many of the women are carriers, but as all could not be determined no attempt was made to tabulate them separately.

The one woman of formula BB×bb who was bald became so through poor health in addition to a simplex inheritance.



BALDNESS IN WOMEN (Chart 5)

Generation I. I 1 was completely bald. I, 2 is questionable.

Generation II. II 1 became bald at fifty-five. II 2 was partially bald. II 3 and II 4 were both completely bald.

Generation III. III 1 was completely bald became so at twenty-five. III 2 had very thin hair. III 3 is questionable, as is also III 4.

Generation IV. IV 1 has been completely bald ever since he was twenty-five. IV 2 is partially bald. (Fig. 9.)

of II 2, became bald at fifty-five. In a mating of this description one-half of the daughters would probably be bald. Actually, one daughter, III 1, became completely bald at twenty-five, III 2 was never bald and III 3 is questionable. She probably became bald as both of her children, IV 1 and IV 2, were bald. IV 1 was partly so and IV 2 became completely bald at twenty-five. Considering B as the presence of baldness and b as the absence of it, the mating in the first generation was probably BB by BB. However it was not tabulated because of the uncertainty.

In the tabulation of the twenty-two families studied, the actual results coincide almost exactly with the expectation, except in the column marked Bb by bb. The discrepancy between the number of sons and daughters exists because some families submitted did not consider any members but the men. The excess of bald men over men who are not bald can be accounted for by the fact that some of the matings were probably Bb by Bb or BB by bb. Women who are Bb cannot be distinguished from bb. They were all considered bb unless definitely known to have male relatives who were bald. Men BB for the trait are no different from those who are Bb. Consequently all bald men were recorded as Bb.

While the study is not complete

these are the conclusions that can be drawn from the work already done.

Baldness is inherited as a dominant character from father to son, and may be transmitted through the mother though she is not bald. A man who does not show baldness himself cannot transmit it to his children.

Baldness behaves as a recessive in women, appearing only when the inheritance is duplex. It is a sex-limited trait. This explains why baldness is uncommon in women, but also explains the few existing cases.

Some women become partly bald through illness in addition to an inherited (simplex) tendency.

The other theories advanced as to the cause of baldness are not satisfactory. Diseases of the scalp cannot explain pattern baldness. Very heavy hair is often associated with entire baldness on the top of the head.

Illness explains a few cases, but cannot explain the great prevalence of baldness. It does not explain why some individuals in extremely poor health retain heavy hair, and many healthy people become bald. In case baldness is due to poor health there is also an hereditary tendency.

Pressure on the scalp, as an explanation, is unsatisfactory. Many men wear tight hats which do not affect the persistence of the hair. A few of the bald men in the families studied had worn tight hats, but the majority had carefully avoided them. Contrary to the main argument in support of this theory women do become bald. It is an uncommon occurrence, but the charts readily explain that. Few people realize that the condition exists because women can conceal their baldness much more easily than men.

These theories do not agree, and none in itself is satisfactory. Heredity as a cause of baldness explains away these difficulties. It explains the presence of a pattern, why healthy individuals are afflicted, and why it is so common in men and exceptional in women.

The Nassau County Survey

The eugenic survey of Nassau County, Long Island, New York, which was described in the May issue of this journal, is well under way. It consists essentially of an examination of selected persons in all parts of the county, and all persons in selected parts of the county. The first object is to find the amount of mental defect in the community; the second is to get a picture of the eugenic constitution of the community, showing the economic productivity, health, and fertility of various sections. The director of the survey is Dr. A. J. Rosanoff, of Kings Park State Hospital, and the general supervision is in a committee, made up as follows: Dr. Charles B. Davenport, director of the Eugenics Record Office, chairman; Prof. Stephen P. Duggan, Professor of Education, New York City College; Elizabeth E. Farrell, Inspector of Ungraded Classes, New York City Public Schools; Homer Folks, secretary, State Charities Aid Association, New York City; Dr. Thomas W. Salmon, medical director, National Committee for Mental Hygiene, New York City; Dr. August Hoch, director Psychiatric Institute, Ward's Island, N. Y.

The American Genetic Association feels that such research work as this is the most important contribution that can be made to eugenics at the present time. As a mark of this appreciation, the above-mentioned members of the survey committee have been added to the research committee on eugenics, of this association, for the current year. Dr. Davenport has been for many years secretary of this committee.

EVOLUTION AND MAN

Several Human Races Likely to Merge and Form One Great Hybrid Race in the Future—Variation Thus Created Will Present Many Possibilities to Eugenics—What Eugenics Can Do at the Present Time

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CHANGE of emphasis is as characteristic of scientific thought in its progress as is change of style in clothes. Today genetics has the stage. A generation ago biologists were discussing evolution. A half generation later the strenuous discussion as to the inheritance of acquired characters was just closing with a recognition of the lack of evidence in favor of such inheritance. Natural selection became dominant; sexual selection being increasingly questioned except among humankind. Orthogenesis was generally accepted as of some moment.

This idea, however, of definite trends in evolution (orthogenesis) secured less attention than it deserved until the discussion of the inheritance of acquired characters became less absorbing. It was then that the abundant paleontological evidence of evolution by minute changes, too minute to be of "selection value," came to be recognized not as establishing the inheritance of the effects of use and disuse, but rather as indicating the presence of trends of variation in particular directions. It even became evident that these trends in definite directions might produce hurtful results, even leading to the extinction of species.

The huge saurians developed to such size that their very bulk aided in their extinction. The trilobites, so prominent in many fossil faunas, became extinct after a development which culminated in most bizarre forms, so eccentric as probably to indicate an unbalanced condition physiologically as well as structurally. To the paleontologist it is clear that in a number of groups of animals the highly evolved forms have become extinct, the several groups being represented today by forms much simpler than many that have perished and perished very likely because of overdevelopment.[1] The minute changes in the structure of the feet and in the ridges of the grinding teeth in the horse, familiar to anyone who has read any book upon evolution, cannot by any stretch of the imagination be regarded each as of such value to their possessor as to have determined his survival in the struggle for existence. A better example of orthogenic change, showing inherent trends, could hardly be given. And these changes are not step by step related to utility. Indifferent for long geologic periods during their gradual development, they have now, however, culminated in a condition of specialization so extreme as to threaten the extinction of the horse. Only domestication saves him. The horse is a most grotesque, outlandish animal, a one-toed beast with a head as long as a barrel, a stiff inflexible animal that can't even lie down, much less roll over, without an awkwardness beyond belief, if we had not seen it. Only familiarity breeds respect for the horse. He has a stiff, unplastic quality, is overspecialized until he can fit into only a very narrow field in nature, living in herds upon open plains. Man's spread over the earth has produced a change in environment to which the horse could never adapt himself unaided. Indeed, barring the effects of domestication by man, the whole great group of the Ungulates is on the same road to extinction which the Dinosaurs have traveled before them. The destructive effect of evolution is a

[1] This does not imply that many less-developed forms have not perished also. Over-development is not the only cause of extinction.

subject worthy of extended treatment, but it is not quite germane to the main thesis of this discussion.

Our paleontological records indicate that orthogenesis has been a widely prevalent factor, and in our mental picture of the evolutionary process it should be given a salient position. Natural selection has consisted largely in the elimination of species whose unfitness was shown only after a long period of indifferent orthogenic development. In human evolution and in the growth of human culture as well, such trends may well have played a major rôle. The relative immunity of certain races[2] to altruism, which has more or less infected some other races, chiefly since Jesus' time, may profitably be considered from the standpoint of racial qualities as developed trends.

ISOLATION OF HUMAN RACES

Gulick and Romanes brought out very clearly the importance of isolation as a factor in evolution, and it is of especial interest in human evolution. The development during the last half million years of so many races of men, some now extinct, some persistent as relatively pure stocks, others intermingled, has been greatly influenced by isolation, has indeed been possible only through this factor. The spread of man over the whole of the habitable earth and the development of communication are destroying isolation and removing it as an influence in the evolution of man. We are approaching the time when every man may fairly be called every other man's neighbor. Intermingling of the peoples through travel, and that breaking down of social bars which always results from the growth of cosmopolitanism, are rapidly reducing the hindrance to amalgamation of the races which existed during the now passing age of relative isolation. It seems clear that there is destined to be but one race of mankind in time, a highly hybrid stock to which all of the present races which are able to persist shall make their contribution.

Both processes, extinction and fusion, have been taking place in America's short history, and with such rapidity that they can actually be observed. The unplastic Indian of the East and of the Great Plains and the still more conservative Pueblo Indian of the dry country of the southwest, are disappearing and seem destined to extinction. The negro, on the other hand, is increasing and is rapidly being whitened in spite of strong distaste on the part of the white race to intermarriage and the enactment of stringent laws against such intermarriage. A still better example of the impotence of social ostracism to stay the process of racial fusion is furnished by the Jew, whose blood is strongly infused into all the major nations of the Occident. The Syrian Jew is plainly a Syrian, the German Jew largely a Teuton, the Spanish Jew has absorbed many Spanish characters. Each of these Jews resembles his local neighbor more than he resembles his brother Jew of another country, and this racial fusion has come about in spite of a social ostracism of centuries more rigorous than we of today, especially we Americans, can adequately conceive.

Given racial contacts, even the illegitimate unions, it seems, must be sufficient in time to cause fusion of all races into one. Of course to the biologist, accustomed as he is to think of evolution in periods of geologic time, a thousand years are as one day. The amalgamation of the races of man into one race about as homogeneous as the present European population will doubtless take a few thousand years to accomplish, but, so far as we can judge from the conditions now existing and those seemingly necessarily about to come, such union of the races seems inevitable. And it has one feature of great advantage: it will give in the resultant race a great variety and diversity of unit qualities to be manipulated in eugenic marriage. The greater the range of qualities the greater the possibilities, for both good and evil.

[2] The author has in mind here the Greeks and the Germans, peoples whose philosophy of life has been self-development rather than service.

From the point of view here suggested the most interesting ethnic questions are: first, those concerning the ability of any human stock to survive in the competition, and second in regard to the character of the contribution of any surviving race to the ultimate human race and its effect upon the ultimate race. To the biologist such social problems as immigration and internationalism, while timely and important today, seem very transient.

Thus far we have mentioned only long familiar factors of evolution. There has been some change of emphasis in these fields, but no new discovery. In the field of heredity, on the other hand, there has been discovery, and a new science—genetics—has been born. We have found that there are two fundamentally distinct types of variation—the first producing new qualities that are not transmitted in breeding, and the second producing characters that persist and breed true. The latter are mutations and are the material with which evolution deals. The transient, unstable type of variation is but shifting sand and gives no foundation for the erection of any superstructure of evolution.

TWO KINDS OF VARIATIONS

In discussions of these relatively new phases of the science of heredity there has been undue emphasis upon some of the less vital features. It is true that the changes produced by mutation (variation of the stable type) are generally somewhat greater than are the changes seen in fluctuating, unstable variation, but this distinction is not universal nor really of much moment. It is the heritability or non-heritability of any newly acquired quality that is of fundamental interest. The usual British terminology, which calls the non-heritable variations continuous and the heritable discontinuous, emphasizes the minor fact that the former are usually slight and the latter greater in amount. It seems far better to call them unstable and stable, emphasizing thus their most fundamental quality of non-heritability or heritability.

Not only have we learned this great distinction between heritable and non-heritable qualities—we have also found out a few fundamentally important things about the manner of inheritance of the heritable qualities, of the way they behave in inheritance. We think we know that the resemblance between parent and child is not a vague general resemblance, that the child does not inherit resemblance to either parent as a whole or a sort of fused resemblance to both, but rather that he inherits particular qualities, or to be more accurate, inherits a series of determiners each of which is related to the development of a particular quality. We think too that we have found satisfactory evidence that in general the child carries two determiners for each heritable quality, one received from the father, another from the mother.[3] We are beginning to learn something of the interrelation and interaction of the two determiners of each pair within the body of the child, and especially we think we know some fundamentally important features of their behavior in connection with the process of fertilization, which starts a new individual in life.

This is not the place to discuss the phenomena of genetics in any detail. Suffice it to say that inheritance is not vague but definite, not general but particular. Stature is not inherited but rather the child receives from its two parents a whole double series of determiners which guide the development in a number of particular ways affecting stature. Brown eyes are not inherited, but rather apparently two pairs of determiners, each pair for a distinct pigment, whose combination produces a brown iris. Brown hair, red hair, flaxen hair, is not inherited as a whole, but rather there seem to be two pairs of hair pigment determiners which when present in full activity produce even so-called black hair, and the absence or perhaps the relative inactivity of one or more of these pigment

[3] One or occasionally both determiners of a pair may be absent, the quality itself being in the first instance less developed and in the second instance wholly absent.

determiners results in various lighter shades. In the complete albino all pigment determiners are absent or at least inactive. It is altogether possible that specific activators must ultimately be brought into our conceptions of inheritance.

INHERITANCE IS PARTICULAR

The thing desirable to emphasize here is the particularity of inheritance. Every individual is a complex of minute discrete qualities which in inheritance act more or less as independent units and so are commonly called unit characters. As the independent inheritance of discrete qualities was first discovered by Gregor Mendel, these unit qualities are often called Mendelian units, and their inheritance as independent characters is called Mendelian inheritance. It seems to many students to become more and more evident that all physical inheritance is Mendelian, though the phenomena are often so complex that their complete Mendelian analysis, their analysis into units of inheritance, is extremely difficult or even completely baffling. All this is distinctly new.

The science of genetics is but a half generation old and it is still in its infancy. Great progress is being made, American biologists marching in the van, but the fields still unexplored are vast and many decades are needed for their conquering.

For our present consideration the thing of interest is the fact that we have learned to some extent how to get results from directed breeding. We know how to breed out and throw away particular unit qualities and we know how, on the other hand, to collect and increase them. Having certain unit qualities in a given lot of animals of any species, and having so analyzed them that we know them as units and understand their reaction in combination, we can shuffle them as we will and produce all sorts of combinations within the limits that the life processes place upon our experimentation. One point of much importance must be emphasized. While breeding can combine qualities already present in the selected individuals, and nurture can often bring such qualities to fuller development, neither breeding nor training can put in what is not already present. We can make new combinations, but we cannot create new qualities. For these we are dependent upon Nature's gift. We must make the best of what she provides.

How does this advance in our knowledge of heredity affect the future of man? How about eugenics? Can we control human development and evolution? There are a number of subsidiary questions that need answering before we can speak confidently of the larger matter of human eugenics. If we should control marriage to this end, we could, of course, produce great physical change in man. With sufficient study probably we may come to understand the unit qualities in most if not all of his physical constitution and we may hope to know how these behave in inheritance. May we hope to analyze psychic qualities into units of inheritance? Are there such psychic unit qualities, and if so are they within reach of our analysis? Are there such things at all as heritable psychic qualities? At least one American psychologist is very skeptical of the inheritance of psychic qualities and regards as especially improbable the whole idea of units of inheritance in psychic qualities.

I know that in the field of psychology I "speak as a fool," yet as a fool, I am convinced by the evidence that psychic inheritance is a fact. We don't know what that which we call disposition is, but it seems to be a complex of psychic qualities, and among men and domestic animals it seems to be heritable. A Jersey bull or a Spitz dog is of uncertain temper. A Hereford bull or a Newfoundland dog is more dependable. These qualities are heritable. Individual dogs of the same breed differ in intelligence and in disposition and, though the evidence is as yet not carefully scrutinized, we are all convinced that such individual differences are heritable. Is the savagery of the Apache or the mildness of the California

Digger Indian any less heritable? Admit to the full the influence of training, especially of subconscious training, and still it seems we must believe that qualities of intellectual ability and of disposition are inherited and that moral stamina and moral weakness are not wholly matters of education. Indeed one is inclined to believe that at bottom these qualities, when strongly present, are less affected by training during the life of the individual than has long been thought, and of course their inheritance is not at all so affected.

MENDELISM IN THE MIND

But if we grant that psychic qualities are heritable, and not merely racial qualities but individual qualities as well, we are still without satisfactory evidence of the presence of Mendelian units in psychic inheritance, and of the manner of their behavior in transmission. If there be units of psychic inheritance, their interrelation may be too complex for analysis. There is no certainty of completely satisfactory solution of the problem even in the distant future.

Leaving out of account for the moment all social considerations and viewing the problem of human eugenics as we would that of animal breeding, could we, if free to do so, so manipulate human beings in marriage as to control psychic as well as physical qualities? Is analysis into Mendelian units necessary to success in breeding?

Thorough analysis is surely the greatest aid, but some result is possible without it. Burbank never analyzed his problems, but he got results, as did all the breeders before his day who produced our diverse breeds of domesticated animals and plants. To be sure they met many failures, but they had some successes. Galton, Pearson, and their followers in the British school, show little interest in Mendelian analysis and are approaching problems of human inheritance from a very different angle. How far we could go by their uncritical method is a question, but something we could surely gain. We could eliminate the undesirable and advance the race nearer to its present best.

But under conditions as they are can we do this? How much hampered are we by social limitations?

Looking far into the future I have entire confidence that we shall in time almost banish physical, mental and moral[4] invalidism, which today are most prominent characteristics of the human species. Negative eugenics, the elimination of the clearly unfit from parenthood, has come and with more knowledge, will be more important, whether the unfitness be physical or psychical. To be sure it may be a thousand years or two before we approach this goal, but to a biologist this is but tomorrow. For the sociologist who thinks in decades there is less comfort in the prospect, though there is much to justify a hope that progress is to be really rapid, a few centuries accomplishing much.

How is this to be? What is the method of approach? *First*—promote the study of the science of genetics by great foundations richly endowed. *Second*—gather with thoroughness and the greatest possible completeness data as to the now existing human stocks. *Third*—educate to ideals of eugenics. *Fourth*—legislate. A few words about each of these four exhortations.

Study of the Science of Genetics.—There is work here for many students for many decades. It must be unhampered, purely scientific work. There must be no necessity of producing "practical" results in order to appeal to the popular imagination and gain financial support. Get good men, then let them alone, don't pester them, and in time there will be gathered a great body of carefully scrutinized data upon which to found intelligent practice of eugenics.

Gather Data as to Existing Human Stocks.—The state should at once gather the fullest data as to matters of possible importance for eugenics (and perhaps as to other things of interest in connection with inheritance) for all families represented in our public insti-

[4] This is used as a conventional, not a strictly scientific classification.

tutions for the care of the defective and delinquent, and similar data should be gathered by privately endowed institutions of similar purpose. Privately endowed investigations should gather inheritance data as to all types of human stock, especially the most desirable. All these data should be gathered, studied and filed by thoroughly trained experts. They should be open to inspection only by those who can show valid reason for such privilege. Contemplation of marriage by or with a member of any family included in these records should of course make the records available for study. In imagination one can see the day when inheritance records will be made by the State for all individuals and these files be the most valued of all records, but that day is far distant.

THE EUGENIC CONSCIENCE

Education to Ideals of Eugenics.—This includes, first, the education of college and university students in the phenomena of inheritance and, second, education of society to an appreciation of the necessity and beauty of the practice of eugenics. This education of society will come chiefly through the pulpit, the stage, our novelists, poets and essayists. The education will not be real and vital until it has taken such hold of the imagination and has so molded ideals that non-eugenic marriage shall seem unbeautiful and repellant. There is no other crime so heinous as intentionally sharing in bringing into the world a human being who, there is reason to believe, will be an injury to society. This is vitiating the very fibre of the human stock. Not only is the bearing of such children criminal—accessory to the crime are charitable persons, or professional workers in charities, who express their sympathy for the individual in ways that result in such injury to society in the coming generation. The agents of our charitable organizations and the officials guiding state activities in relation to the defective and delinquent, often do not now have in mind the rights of society in the coming generation, to safeguard those rights. But, of course, appreciation of the principles of eugenics, and respect for them, is a primary requisite for fit service in these lines and should be so recognized. We know as yet but little in this field, but we must not be false to so much of the truth as we have attained. In promoting ideals of eugenics the immediately practical thing is to educate ourselves and our fellows to a warm appreciation of physical, mental and moral soundness and wholesomeness, such appreciation as will make these qualities the most attractive in choice in marriage. This is a long, slow process, but there is never any short cut to results of really vital importance. After 2,000 years the altruism of Jesus has only begun its beneficent work in those aspects of human relations long recognized. It must reach to and come to be controlling in this newly recognized and higher phase of social morals.

Legislation.—This is a minor feature to one who takes the "long look," but it is essential. Legislation can never express and enforce an ideal that is not general, and one does not see that it can ever be more than purely negative, debarring certain clearly recognized types of defective men and women from marriage. In cases of congenital feeble-mindedness and inherited insanity, if accurately diagnosed, segregation may now wisely be used. But legislatures have positive genius for mistaken legislation in scientific matters, and they are sure to be urged by well-meaning but ill-informed persons to enact unwise laws, as some states have already done. Legislation which goes too far or is ill-founded will set back, not advance, eugenics. If one State should enact moderate segregation laws based on sound scientific data and drafted under the advice of those most conversant with these data, it would do great service not only to itself, but also by its example. One concrete instance of wise legislation would not only be a stimulus to other states to enact similar laws but could be used as a deterrent in cases of proposed laws founded on enthusiasm and not on knowledge. So-called eu-

genic legislation to the present time has been mostly unwise and will prove a hindrance.

We have discussed thus far only negative eugenics, the elimination from child bearing of those recognizably unfit. Even without Mendelian analysis it seems probable that ultimately much may be accomplished by the acceptance of more wholesome ideals of attractiveness in marriage. Through centuries of advance in culture, physical attractions have come to be largely supplanted by spiritual qualities as stimuli to choice in marriage. This change shows how possible it is to modify the standards even in this the most vital, most biological, of all human relations. We may surely anticipate bringing the human stock into a condition more nearly approximating its present best by removing the distinctly undesirable types.

CONSTRUCTIVE EUGENICS

Positive eugenics involving controlled marriage for the sake of bringing together individuals whose children would be likely to be especially valuable to society, seems unattainable without violence to the principle that love between husband and wife is the safest, the most beautiful, foundation for the home, and that the home is essential to the best type of society. Possibly in the case of a people like the French, or still more the Japanese, among whom marriage is arranged by the families rather than the individuals involved, considerations of positive eugenics might come to be controlling, as considerations of wealth and social status are today in large measure. But any attempt to unite a particular man and a particular woman in marriage for the sake of establishing the resultant family in wealth or social position or even in innate wholesomeness of body and mind seems to us in America not only repellant but socially dangerous. Man is so sensitive spiritually to the environing atmosphere, especially within the family, that this should be of the sweetest, most ennobling type, and to this end nothing else is so important as that there should be between the man and woman founding the family that indefinable attraction we call love, a thing which in primitive man was probably mostly physical, but which at its best today is permeated and suffused with spiritual quality of a type which does most to make a home environment that molds the children into worthy members of society.

The complexity of the problem of eugenics is evident, and the great difficulty of accomplishing to the full the biological result of good breeding without sacrificing the nurtural influences which, while less fundamental, are still essential. Marriage is a most vital thing to the individual and it is socially the most significant of all human relations. The interests involved are complex and may oppose each other. When individual and social interests clash, of course those of the individual give way. The bearing of children is not an individual right, but a social privilege, which may be bestowed or withheld as social welfare shall demand. The only question is, of course, which way social welfare lies—no easy question to approach, much less solve.

Our discussion of eugenics thus far has dealt only with the problem of bringing mankind as a whole nearly to the level of its present best. This is ordinarily what is meant by eugenics. There is a somewhat distinct problem—that of the evolution of mankind to a condition more advanced even than his present best, the bringing of the race to a point beyond the best yet known even in the most desirable individuals. Is there, or is there not, possibility of indefinite advance in humankind? The question of method of securing advance, a question we have already discussed sufficiently to show its complexity, enters here, as it does into eugenics. But there is a further question of material upon which to work. We have convincing evidence that changes effected in an individual through education are not heritable. We have seen also that there are two types of variation producing new qualities which in the one case are heritable, in the other not. Only heritable qualities, stable variations, mutations, can serve as a basis for

evolution. Is man mutating today? Does he present stable variations which may be utilized to secure his evolution to a higher condition? The various species of animals and plants differ in the degree of their mutation. The domestic goose has developed few breeds because it presents few and slight mutations from which to breed new forms. The common pigeon,[5] on the other hand, has evolved under artificial selection into a host of very divergent breeds. To which type does man belong? Is he mutating or not? By his fruits we can know him. Does the species show high diversification into races, or has it remained fairly uniform?

SEVERAL SPECIES OF MAN

We have evidence of at least two species of true men, the Neanderthaloid species, *Homo neanderthalensis*, with perhaps more than one race, now wholly extinct, and *Homo sapiens*, with at least three subspecies represented in Europe and with numerous very divergent races scattered throughout the habitable earth.[6] To reach this condition of great diversity, mutation must have been frequent and considerable in degree in the past, and we have no reason to suppose it less today. Few species of organism show more abundant or more extreme mutation than man. The races of men differ not only in such physical characteristics as stature, color, shape of cranium and of face; form of features; color, position and shape of eyes; color, shape and coarseness of hair; relative length and size of different portions of skeleton; form and size of teeth; and numerous others—they differ no less in mental qualities, in intellectual ability, in educability, in disposition. Yes, mutation, physical and mental, has been prevalent in the past and is doubtless continuing today.

Much of the change we see appearing in human families from generation to generation may be but the resolution and recombination of qualities already in this highly hybrid stock, but the evidence from his past shows almost beyond question that new features must be appearing through mutation and joining the huge jumble of qualities which are reshuffled with every marriage. Along with the ancestral qualities and the new mutations, all heritable, are of course numerous non-heritable features which have arisen by variation of the non-stable type. The condition is one of great complexity, difficult of analysis even if we were free to use experimental breeding. Without experimental breeding, using only observation of chance matings, as is necessary under the conditions presented by human society, the analysis of the conditions presented seems nearly hopeless. We shall learn something, much in time, but it will be slow progress at the best.

New qualities which arise in any species are often slight at first, their value appearing only after generations of orthogenic intensification. In experimental breeding many such must escape notice and be lost. Among humankind any quality to be repellant or attractive in influencing marriage must be well developed and prominent. Marriage selection, therefore, cannot act upon any new quality unless it be well developed at its origin (what breeders of animals and plants call a "sport") or until, if slight at first, it be given probably many generations to develop and become prominent. We should note further that by the time adult life is reached every individual has been so modified by education and by self-training that his inborn character is obscured, so that he may be chosen in marriage on the basis of character which in considerable degree is "acquired" and therefore is not transmissible. The subject is extremely complex. Not even its outlines can be indicated in this paper.

What conclusion, if any, can we

[5] It is possible the domestic pigeon is of hybrid origin. Better examples of non-mutating and mutating stocks would be the potato, which has shown little divergence under prolonged cultivation, and the wild cabbage (*Brassica oleracea*) which has been developed by selection of its mutants into the domesticated cabbage, kale, Brussels sprouts, cauliflower, kohl rabi, and Swedish turnip, leaf, flower and stem all having been greatly modified.

[6] Cf. Osborn, Henry Fairfield, "Men of the Old Stone Age," New York, 1915.

reach? Can genetics and eugenics register in human betterment, in improvement of the stock itself? Surely they can if we will have it so. But will we consent? Again surely yes. The ideal of a human race wholesome in its innate character is so beautiful that it must win its way. Caring for the weak, comforting the sick, rescuing and regenerating the base, are beautiful, but how much more beautiful it is to build a race that is physically sound, intellectually keen and strong and whose natural impulses are wholesome! Not a race of men who are decent because they are restrained from following their natural bent, but a race whose natural quality is wholesome, who need not so much to restrain as to develop themselves. This seems destined to be included in the religion of the future, and it is Christian; not in Jesus' thought, so far as we can judge, but a necessary development of his gospel of altruism. If the facts of human inheritance are as they seem to be, man's future takes on a new glory.

ANTITOXIN FOR CIVILIZATION

Thirty years ago Carpenter[7] wrote a keenly interesting essay in which he depicted civilization as a disease from which no people, once afflicted, has ever made a good recovery. He traced its history in several peoples, showing its similarity in all, the same prodromal stages, its culmination in feverish strength, and the patient left either dead or permanently weakened. It was not a pleasant study, for it had too much of truth. The people who make eugenics part of their religion and are loyal to its truth will have found the antitoxin for this dire disease, and with it the fountain of youth. But this is a dream of the distant future, the day of that ultimate race that shall people the whole earth. Yet we can carry this dream with us, can have the inspiration of the vision, and can be loyal to it in our endeavor to secure to children their right to be well born.

We have said that the gospel of eugenics is Christian. Can any follower of Jesus see this ideal understandingly without finding that all his loyalty to Jesus' gospel of altruism is back of it to push it? Eugenics is also Confucian. This religion of common sense maxims, if it be called religion, has broad contacts with the religion of eugenics. There are also possible considerable contacts with Buddhistic philosophy. Forgetfulness of self and merging all into the infinite completeness of the whole Communion of the Universe are ideas that readily unite with the ideal of eugenics. Islam is not sufficiently altruistic to let us hope that it can help toward the enforcing of eugenics, though pride of birth and joy in worthy sons is highly characteristic of many Mohammedan peoples. Shintoism might be brought to urge improving the quality of those who are to be given as ancestors to posterity. The contacts with Shintoism may conceivably prove of practical value.

Among the civilizations of the world positive antagonism to eugenics is hardly to be expected. Buddhism is too contemplative to push anything. Shintoistic-Buddhistic-Christian Japan, with her readiness to adopt new conceptions if they look to national advantage, may perhaps be among the first to grasp and enforce eugenic ideals. But for its real growth eugenics seems, as a matter of fact, if not of philosophy, to be dependent chiefly upon Christian civilization. It is wholly Christian, though not exclusively so, and nothing less seems truly and adequately Christian.

[7] Carpenter, Edward, "Civilization, Its Cause and Cure." London, 1889.

POLLINATING FRUIT TREES

Many Problems Connected with Failure of Trees to Set Crop—Must Be Worked Out by Experiment—Results of Some Long-Continued Trials in England

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IT HAS long been recognized that the chief purpose of a conspicuous flower is to attract insects, which may act as the agents in transferring pollen from another individual. Failing, however, the arrival of any foreign pollen, many flowers are able to set seed with their own pollen and in fact many flowers are provided with various elaborate contrivances, to effect self-pollination, should cross-pollination fail.

There are, however, a large number of plants, which, even when carefully self-pollinated, are quite unable to set seed or develop fruit with their own pollen.

To this set belong many of our common wild plants, and many of our cultivated plants, too; but what concerns the fruit grower most is that many, if not the majority, of our common fruit trees are in this category.

It has frequently been observed by practical men that large blocks of only one variety of apple or pear have fruited badly, except in the outside rows; others have contended that large blocks of one variety have fruited well all through. Both may be correct, and a good deal of the explanation depends upon a clear conception of the meaning of the term self-sterile. A plant is said to be self-sterile when it fails to set seed with its own pollen, though this same pollen may be perfectly potent on another variety. This should not be confused with such cases as occur in the gooseberry and the currant, where, though the flowers are perfectly self-fertile, fruit is but rarely if ever set, if the visits of insects are excluded; here it is chiefly a mechanical difficulty, as the stamens bearing the pollen are situated in such a position that they cannot come in contact with the stigma, the female organ; and, further, the pollen is of a glutinous nature. The practical difference is that, whereas in this latter case a supply of bees would ensure a crop of fruit, even if only one variety be grown, in the former no number of bees would make any difference.

FRUITS WITHOUT SEEDS

There are some varieties of apples and pears which will set fruit on being self-pollinated, but these fruits do not contain any real seeds; such fruits are of course more or less satisfactory to the fruit grower who wants fruit. This also occurs in some varieties of gooseberries; such berries are, however, decidedly lighter in weight than those containing seed, and are therefore obviously of less value to the grower; the apples without seed, also, are often inferior both in size and shape.

In plums and cherries these parthenocarpic fruits do not occur, at least not to any appreciable extent; an occasional fruit may be found with a shrivelled kernel, but I have noticed that, as a rule, if this shrivelling takes place before the fruit is well developed it falls, and I think that it is probably due to imperfect fertilisation.

Plums seem to be fairly equally divided between self-fertile and self-sterile varieties, and there are a few which cannot be directly classified as one or the other. In apples and cherries, self-fertile varieties appear to be greatly in the minority. Through experiments carried out chiefly on pot trees at the John Innes Horticultural

[1] Mr. Corrie was formerly connected with the John Innes Horticultural Institution at Merton, Surrey, England, of which William Bateson is director. The data here presented were accumulated at that institution. With this article the reader should compare "The Self-Sterility Problem" by E. J. Kraus, in JOURNAL OF HEREDITY, VI, 12, pp. 549–557, December, 1915.—THE EDITOR.

Institution in a house where they were strictly isolated from insects, some of the commoner plums, cherries and apples can be classified as follows:

PLUMS

Self-Fertile	*Self-Sterile*	
Denniston's Superb	Coe's Golden Drop	
Early Mirabelle	Coe's Violet	
Reine Claude Violette	Wyedale	
Myrobalan (red)	Grand Duke	
La Prune Giant	Jefferson	
Monarch	Reine Claude d'Althan	
Early Transparent	Pond's Seedling	
Reine Claude Bavay	Washington	
Prince Englebert	Early Greengage	
Early Favourite	Old Greengage	
Gisborne's	Ickworth Imperatrice	
Oullin's Golden Gage	Late Transparent	
Golden Transparent	Curlew	
Victoria	Prune d'Agen.	
Czar		
Pershore		
Magnum Bonum (red)		
Magnum Bonum (white)		
Kentish	River's Early Prolific	Set only about 1% when selfed
Warwickshire Drooper		
Damson var's	Stint, Mallard	

CHERRIES

Self-Fertile	*Self-Sterile*
Morello	Black Heart
Late Duke	White Heart
	Elton
	Kentish
	Big Frogmore Early
	Big Gaboulay
	Early Rivers
	Guinge d'Annonay
	Black Tartarian

APPLES

Stirling Castle	Northern Greening
Baldwin	Lord Hindlip
Washington	Cox's Orange Pippin
	Bramley's Seedling

Parthenocarpic:
Lord Derby
Duchess of Oldenburg

It will be noticed that on the whole the self-fertile varieties correspond with the best croppers; this, however, though general, is not always the case, for Rivers' Early Prolific, which is usually a great cropper, is from a practical view self-sterile, setting only about 1% of its flowers when self-pollinated. May Duke cherry behaves in a similar manner.

I think it will be found that some varieties of plums are better pollenizers for certain varieties than others; when the Old Greengage and the Early Greengage are crossed together only about 8% of their flowers develop fruit. For several years I observed a large block of two varieties of greengages, and although they produced flowers in abundance they never carried a fair crop of fruit; owing to this they have been destroyed. I think that certain definite varieties of plums may prove to be the best pollenizers for the self-sterile gages. Cross-pollination has indicated this, and I have seen greengages, carrying good crops, growing beside Victoria plums.

If the flowers of self-sterile varieties of plums and cherries are not pollinated at all the fruit falls very soon, a few days after the petals, whereas if the flowers are self-pollinated the carpel swells up to the size of a culinary pea before it falls, but fall it will, and it is not until about three weeks after pollination that a self-sterile variety can be distinguished from a self-fertile one.

These self-pollinated fruits, of self-sterile varieties, tend to fall more quickly after a touch of frost, much to the consternation of the grower, who thinks that he has lost a high percentage of his crop from this cause. The careful observer will, however, notice many fruits falling on both self-fertile and self-sterile varieties, at times when there has been no frost; it is due in the former case solely to lack of pollination, and in the latter to the lack of fertilisation as well.

BEES AND NECTAR

It will be seen that it is very important to know one's varieties and in most cases to avoid planting large blocks of the same variety. It should be borne in mind that all the different trees of the same variety, which have of course been propagated vegetatively from one individual, are so far as self-sterility is concerned, but one individual—no benefit is derived by interpollination between such trees. It is known that bees have a wide-working radius, half-a-mile at least, and often they go further afield. It might therefor be argued by some on this account that there can be no objection to large blocks

POLLEN IS TRANSFERRED THIS WAY

When the bee enters a flower he gets pollen on his head or, if the flower is large, all over his body; and naturally leaves some of it in the next flower he enters. In this photograph (posed and made by David Fairchild) it is evident that from the anthers of a small blossom, the bee must carry away a large part of the pollen on his face. (Fig. 10.)

of one variety. It should, however, be borne in mind that it is nectar that the bees are after, and they are not concerned with cross-pollination, so that if there is one variety rich in nectar, there is no reason why the bees should do anything more than simply work backwards and forwards between the hive and this block. I have noticed that the plum, Denniston's Superb, is extremely rich in nectar, I have seen this variety carrying heavy crops of fruit, year after year, and I am inclined to think that its prolific quality is due to its richness in nectar attracting the bees.

It is sometimes stated that wind is an agent in bringing about the pollination of fruit trees. With some plants it undoubtedly is—in fact many are elaborately adapted for wind pollination, the pollen-grains of some cone-bearing trees having wings which enable them to be freely carried by the wind. To endeavour to discover what part wind plays in pollinating fruit trees, we enclosed two young standard plum trees in muslin of a mesh sufficiently small to exclude bees and large flies but large enough to admit wind freely. One of these trees, a Victoria, bore one fruit; the other, a tree of Reine Claude Violette, did not develop a single fruit, whilst neighbouring Victoria trees carried quite fair crops. Both these varieties are self-fertile, and this clearly shows whether a tree be self-sterile or not. Insects are absolutely necessary for efficient pollination.

Another experiment has shown that the stigma, under the best conditions, begins to deteriorate to a marked extent, in regard to its receptiveness of pollen, the eighth day after the flower has opened and with climatic conditions so adverse as is usual with us in the spring, during the period the trees are in flower, its receptiveness is probably of much shorter duration.

With such existing conditions as these, the value of having hive bees in the vicinity, so that they can work freely on the flowers during the short bright spells which often occur during weather which prevents them leaving the hive, cannot be easily over-estimated. The value of the wild bees and other pollinating insects, should not be over-looked, as they work more freely than the hive bees during adverse weather.

THE EFFECT OF RAIN

The effect of rain upon fertilisation is not, to my mind, so deleterious as is generally thought, for experiment has shown that the application of water on the stigmatic surface, two hours after pollination, has no effect whatever in preventing fertilisation taking place, and it is probable that it would not at a much shorter period if weather conditions were favourable. The applications of water were much more severe than would occur in a practical way from a shower of rain, and, considering the small size of the surface of the stigma, I think that the water that would come in contact with and remain upon it is hardly worth considering. A period of rain, however, would doubtless destroy much pollen, and prevent pollination taking place.

The phenomenon of self-sterility presents but half the problem of the pollination of fruit. There is yet the question of satisfactory pollenizers, and this is of most importance. Taking the extreme for an example: several cases have been found where distinct varieties are of no use whatever as pollenizers for some other varieties. After extensive experiments with Coe's Golden Drop, Jefferson and Coe's Violet, there seems but little doubt that, however these three varieties of plums are intercrossed, no fruit will set. Coe's Violet is supposed to have originated as a bud sport from Coe's Golden Drop; if this is correct an explanation is presented, as it would be really a part of the same individual. In the case of Jefferson, however, no explanation can be offered at present. All these three varieties have been crossed with several other varieties, and have set and developed excellent crops.

Excepting the crossing of distinct species, I am inclined to think that these extreme cases of physiological differences may be rare in plums of the domestica group. With apples, how-

ever, I have reason to believe that these cases may be much more frequent, and if it is found to be so, it will be of great importance to the practical man. The variety Bramley's Seedling appears to be of no use whatever as a pollenizer for Cox's Orange, and there is some indication that many other varieties may be found to be similar to Bramley's Seedling in this respect. Other cases have been found where varieties have been crossed, and yet no seed has developed; the carpel has simply swollen up and I have noticed where seedless apples and apples with seed have occurred upon the same tree, that the former have been to a marked extent, inferior in size and in some cases in shape also.

THE PROBLEM OF AFFINITY

Even with varieties which are potent and do produce seed, there appears still to be a variation in their affinity—the pollen from some varieties appears to set and develop a higher percentage of fruit than pollen from others. Cox's Orange has developed good crops when crossed with Stirling Castle, Beauty of Bath and Duchess Favourite.

Although the pollen of Bramley's Seedling is apparently of no use in effecting the fertilisation of Cox's Orange, the pollen of the latter variety appears to be perfectly potent on Bramley's, and good crops have been obtained. Considering this from a practical view, it is possible that a large block of Cox's Orange might be interplanted with Bramleys only, and if no other varieties were in the vicinity the trees of Cox's Orange would be practically barren, whilst the Bramleys would carry good crops. Extending this view: for all that is known at present, Cox's Orange might even be in the midst of several varieties, and they might all be similar to Bramley's in being of no use as pollenizers, and I am inclined to suggest that in some of the cases where Cox's Orange crops so badly it might be due to such conditions as these prevailing, and also in the cases where they crop so well to having suitable varieties as neighbors.

These variations are in no way due to a deficiency of pollen, nor to the failure of varieties to flower at the same time, which is of course essential.

In cherries also there appears to be slight evidence that some sections, or at least some varieties, may prove to be of little, if any, value as pollenizers for other sections or varieties.[2]

If fruit trees in general can be classified from a physiological point of view, as I am inclined to think they can, it will be of real value to the practical man, as he would then be equipped with a knowledge that would enable him to interplant to the best advantage, and I do not think that this would necessarily involve planting, as pollenizers, varieties which are of little commercial value.

In conclusion, I would say that much is still in a negative stage (and also that possibly some of the cases of inefficiency of varieties as pollenizers, may be found to be more or less coupled with morphological differences), but with further critical investigation there is no doubt that many facts will be discovered which will be of great practical value to the fruitgrower, and probably will throw light on some problems of theoretical importance as well.

[2] This is confirmed by American work. See "Sweet Cherry Breeding" by V. R. Gardner, in JOURNAL OF HEREDITY, VI, 7, pp. 312–313, July, 1915.—THE EDITOR.

Bounties for Babies in France

Child-bearing is to become a subsidized industry in France if a bill introduced before the Chamber of Deputies by Paul Benazet is enacted into law. It provides, as summarized by cable dispatches, that the state shall pay $100 (500 francs) to a mother for the first child born, $200 for the second child, $400 for the third, and $200 for each subsequent child thereafter, making payment a year after birth if the child is living. Such measures are probably based more on the need for soldiers than on any other consideration; they are too indiscriminate to be considered eugenic.

SORREL COLOR IN HORSES

Although It May Be Only a Light Chestnut, Evidence Indicates that It Is Inherited Separately and Is Therefore a Distinct Unit—Sorrel Color the Easiest One for the Breeder to Produce at Will

L. P. McCann

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THE sorrel color in horses is not officially recognized by most stud books. The following, however, are exceptions to this: The National Registry of Belgian Draft Horses, The National Registry of French Draft Horses, and The American Shetland Pony Stud Book. All others consider sorrel to be a light shade of chestnut.

Since the inheritance of all other colors has been found to accord with Mendel's Law, it occurred to the writer that there was a possibility of determining whether sorrel is a true color. With this point in mind the matings in The National Registry of Belgian Draft Horses were examined as a source of information.[1]

More than half of the records in the Belgian stud book were covered in order to obtain evidence for, or against, the question at hand. A large proportion of the animals recorded in these books have been imported, and not bred in the United States, and it was therefore impossible to learn the color of the sire and dam of such animals. Work was begun on the most recent volume published, and the preceding volume taken up as the information in the succeeding one was exhausted. Finally a point was reached in the records where the number of animals recorded, that had been bred in this country, was so small that the information gained by going over these records was almost negligible. It was then deemed advisable to stop the work and analyze the data compiled.

At the outset the color of all matings together with the color of offspring of such matings was recorded for comparison with the results compiled by W. S. Anderson.[2] After 400 matings had been tabulated it was apparent that, not considering sorrel, the findings were as nearly like Anderson's as would be expected. From this point only such matings were recorded as were considered of value in determining the inheritance of sorrel.

The final number of matings tabulated is 427, which involves the color of over 1,250 animals. This seems a sufficient number from which to draw conclusions as to the inheritance of sorrel color.

In previous work done on the inheritance of coat colors all other colors were found to be dominant to chestnut. However, the records from which those data were compiled entirely disregarded sorrel as an individual color.

In the table on p. 371 it is seen that from the sixty-three sorrel by sorrel matings sixty-one sorrel, one bay, and one roan offspring resulted. Upon inquiry, the breeder of the bay animal made the following statement as to its color:

"Both the sire and dam were sorrel in color but of a very light shade, and the colt was so light in color that after the coat had been shed once the animal was so light as to make it impossible to distinguish whether it was bay or sorrel."

However, he failed to state whether the mane and tail were light in color, which is characteristic of sorrel, or whether they were black, which is characteristic of bay.

The roan pattern being dominant, it is readily seen that the one roan animal

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[1] Much valuable assistance was received from Prof. W. M. Barrows, Department of Zoology and Entomology, Ohio State University, under whose direction this work was carried on.

[2] Anderson, W. S., "Coat Color in Horses," Journal of Heredity, V, 482–488, November, 1914; and in more detail in Kentucky Experiment Station *Bulletin* 180.

MATINGS OF VARIOUS COLORS AND COLOR OF OFFSPRING

Sorrel	Bay	Brown	Chestnut	Black	Roan
		Sorrel x Sorrel			
61	1	0	0	0	1
		Chestnut x Chestnut			
5	0	0	13	0	0
		Sorrel x Chestnut			
23	3	0	11	0	1
		Sorrel x Bay			
78	95	3	5	10	6
		Sorrel x Black			
9	8	0	1	6	1
		Chestnut x Black			
1	2	1	1	1	1
		Chestnut x Bay			
22	48	0	8	1	0

recorded as an offspring in the sorrel by sorrel cross is due to a mistake in recording, or that one of the parents was a roan animal with a very few white hairs showing, which is a case of incomplete dominance. Occasionally, animals are seen which from a distance appear to be sorrel, chestnut or bay in color, but upon close observation a few white hairs are apparent in the coat. It has been found by other investigators that there are a small number of mistakes in the stud books as regards coat colors, because color is considered a matter of minor importance by a great many breeders.

SORRELS ARE ABUNDANT

The chestnut by chestnut matings, while few in number, serve to demonstrate that sorrel is recessive to chestnut. In order to conform exactly to Mendel's Law the offspring should be in the proportion of three chestnuts to one sorrel, and they do approach this proportion rather closely, being thirteen to five respectively. There is a predominance of sorrels as compared to chestnut, in the Belgian breed studied, and it would therefore be expected that a larger number of the chestnut animals would be heterozygous for sorrel, than if these two colors were present in equal numbers. This is more clearly shown in the chestnut by sorrel matings. Again considering the matter theoretically, if the two colors were present in equal numbers, there should be fewer sorrels than chestnuts resulting from this cross, but there are twenty-three sorrels to eleven chestnuts. The same thing is brought out in the sorrel by bay matings. The sorrels and bays are present in about the proper proportion, but theoretically, there should be a larger number of chestnuts.

The bay by chestnut matings also substantiate the fact that sorrel is recessive to chestnut. If such were not the case the number of sorrels from this cross would be very small as compared to the others, but the result is twenty-two sorrels, forty-eight bays, eight chestnuts and one black.

The sorrel by black matings give a result similar to the chestnut by black matings. The former gives nine sorrels, eight bays, one roan, one chestnut and six blacks, and the latter, one sorrel, two bays, one brown, one roan, one chestnut and one black, showing that sorrel and chestnut are qualitatively alike. The occurrence of bay offspring from these matings is explained by Prof. E. N. Wentworth[3] in the following way:

"The bay coat results from the presence of two pigments in the hair tubules, viz., red, and black. There is a factor associated with the red pigment which restricts the appearance of the black pigment to certain parts of the body, as the mane, tail, legs and around the eyes. In the case of sorrels and

[3] "Why is a Horse Bay?" *The Horseman*, November 10, 1914.

chestnuts the coat color is due to the red pigment alone, but the restriction factor is also present. Since there is no black pigment present in these animals this factor cannot exert itself until the black pigment is brought into the cross by the other parent, as in the case of black by sorrel matings."

INFORMATION WANTED

One point which might prove of value in determining the difference, if there be any, in the pigment which produces sorrel and that which produces chestnut is this: Are the bay animals from sorrel by black matings lighter in color than the bays from chestnut by black matings? Information pertaining to this point will be gratefully accepted.

The appearance of roan offspring from most of the tabulated crosses, as well as the three bays resulting from the chestnut by sorrel cross cannot be accounted for, except by mistakes in the records as previously mentioned.

The fact that the sorrel by sorrel cross gives sorrel offspring in practically 100% of the cases is rather definite proof that sorrel is a unit character, and further, that it is recessive to all other colors. Therefore, the breeder who is desirous of producing sorrel animals has an easier task than the one who desires to produce animals of a color other than sorrel. The former will be certain of getting sorrel colts as long as he has a sire and dam of sorrel color, while the latter cannot be certain of the results from the cross of any other color. With sorrels becoming rather popular, especially among pleasure horses, this point will doubtless be of some value to those who make a business of producing such animals.

A Magnificent Flowering Vine

Camœnsia maxima, discovered by Welwitsch in tropical Africa, has probably the largest flowers of any of the Leguminosæ. Blossoms produced under glass by the Department in Washington were illustrated in the *American Breeders' Magazine*, IV, p. 212, December, 1913. Robert M. Grey of the Soledad Sugar Co., Cienfuegos, Cuba, who has been growing this vine in the open air, writes: "The clusters of flowers are beautiful, large and the gilt-edged petals appear hand painted. The change of this tracery from gold to brown on the second day is equally remarkable. The aromatic fragrance which can be detected 20 or more feet distant is very agreeable.

"The Camœnsia vine is growing in rather clayey soil with a reddish rotten-stone subsoil, on a dry situation, but gets abundant water during our wet season and is occasionally watered during the winter or dry season, but stands considerable drought without injury. It will grow in full sun, also full shade, but makes more luxuriant foliage where partly shaded. Flowers are produced several times annually. I believe the vine could be acclimatized in the hammocks of southern Florida with little or no trouble and the natural distribution of its seeds would cause it to spread rapidly."

Members of this association who are in a position to grow this vine, either under glass or out of doors, can probably secure seed by communicating with the Office of Foreign Seed and Plant Introduction, U. S. Department of Agriculture, Washington, D. C.

Eugenics Research Association

Dr. Adolf Meyer, director of the Phipps Psychiatric Clinic, Baltimore, was elected president of the Eugenics Research Association, at its annual meeting in Cold Spring Harbor, L. I. William F. Blades was continued as secretary-treasurer of the Association.

PHILIPPINE HORSES

First Brought to the Islands from Malaysia—Later by the Spaniards from China and Japan—Direct Spanish Importations Very Late—American Efforts to Improve the Breed

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EVERY visitor to the Philippines has had an opportunity to observe the many good qualities possessed by the native horse, or pony as it is more often called. Despite its diminutive size, it is often seen hitched to a native carretela (two-wheeled vehicle) and drawing a load of half a dozen persons, at a gait of six miles an hour, without regard for the tropical heat.

During a sojourn of seven years in the Archipelago, and experience of every province, I have been much interested in learning the origin of these native horses. Extensive questioning of both Spaniards and Filipinos has brought in every case the same answer, a perfectly natural one, that the horse was first brought to the islands by the Spanish conquerors. Some Spaniards, however, asserted that the native races contained a considerable infusion of Arab or Barb blood, but this was probably little more than a guess, based on the fact that the renowned Andalusian breed contains much of that blood, and might well be supposed to have been brought to the islands from Spain.

Study of evidence from many sources has convinced me that the common opinions are largely erroneous, and the object of the present paper is to cite in chronological order the data which I have been able to collect, to show exactly what the Filipino horses are, from a genetic point of view.

With reference to the introduction of horses, Philippine history may be divided in four periods:

1. The period when horses were altogether unknown to the inhabitants of the archipelago.
2. The period of first introduction of the horse, with the Malay migrations from the Malay Peninsula and Sumatra to Sulu and Mindanao.
3. The period of Spanish occupation.
4. The period of American occupation.

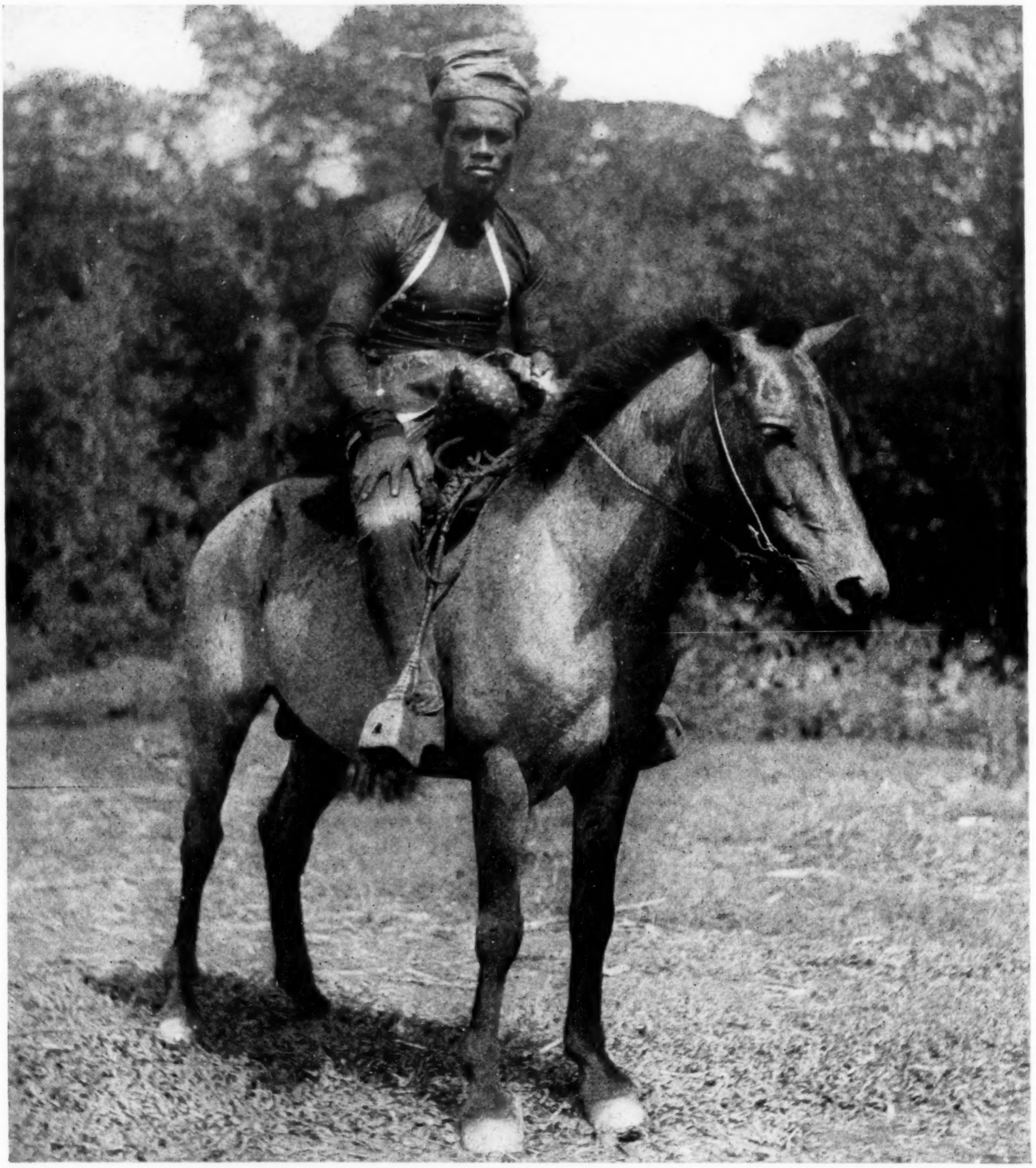
Evidence that the horse was unknown to the aborigines prior to the Malayan invasion depends on the fact that every wild tribe in the islands (except the Muhammadan tribes) knows the horse only under the name of *kabaya*, a corruption of the Spanish *caballo*. Had the horse been known to them before the Spanish conquest, they would certainly have had a native name for it.

The evidence that horses were brought to some of the southern islands, at least, by the Malay invasion, is pieced together from a number of different sources, the Moro chronicles being too brief to afford much information. I shall present the data and allow the reader to decide whether or not it is adequate to support my position.

NATIVE NAMES FOR THE HORSE

In the first place, we know that the Moros—the Muhammadan peoples of the south islands—were familiar with the horse, because they have names of their own for it: *kuda* (Sulu) and *kura* (Magindanao).

Turning now to the history of Sulu, we read of the period of Malayan invasion: "Two prominent characters which mark the era are Makdum and the Rajah Baginda. Makdum was a prominent Arab judge and scholar who arrived at Malacca about the middle of the fourteenth century and converted the ruler, Muhammad Shah, to Islam. . . . Continuing farther east he reached Sulu and Mindanao about 1380."



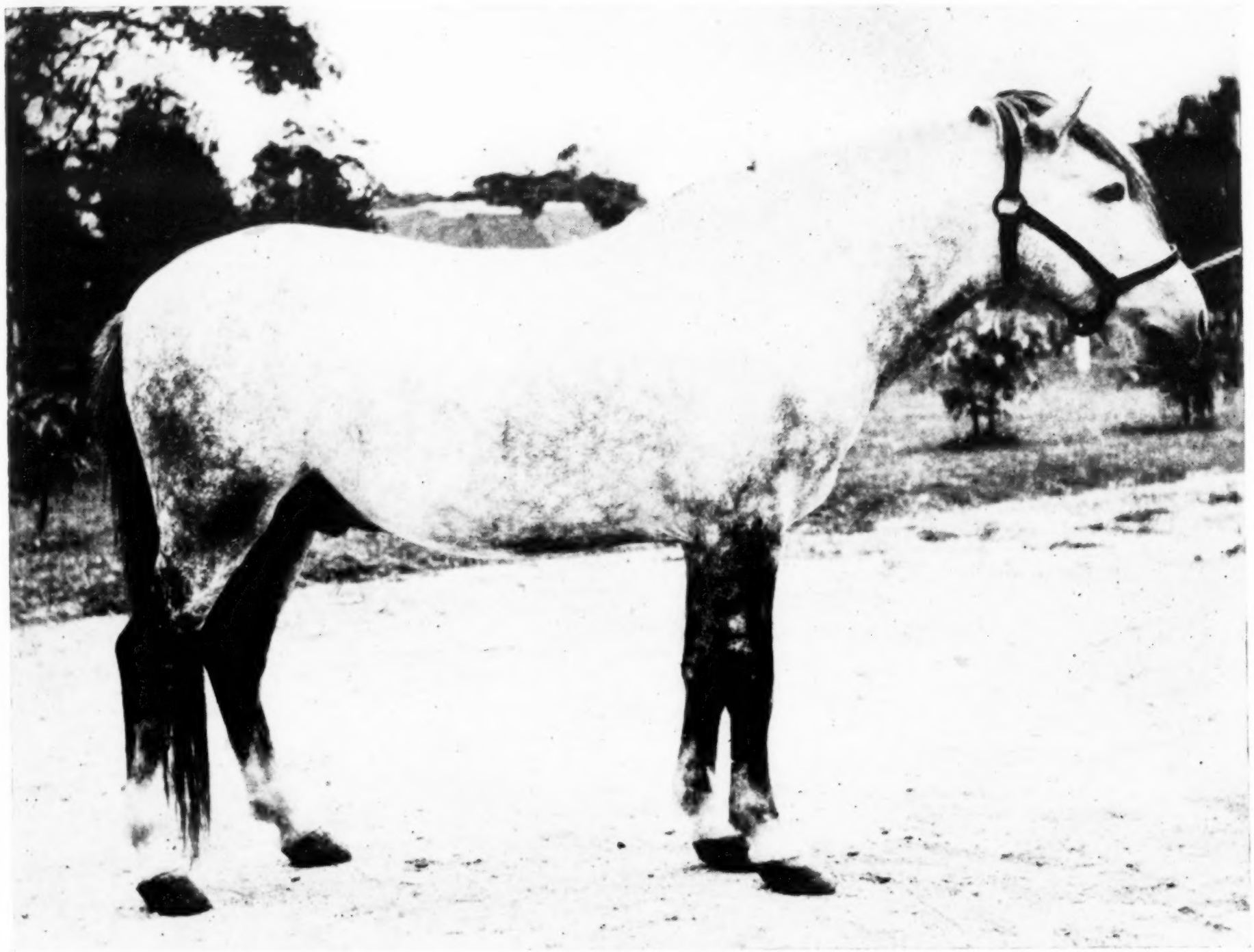
THE SULU PONY IS THE OLDEST TYPE

Long before the Spanish conquest, the Muslim tribes of the southern Philippine Islands had horses, which apparently came from Sumatra. The stock is still fairly distinct from that of the northern islands This photograph shows a good specimen of the breed, with Sulu rider. The bridle is the last word in simplicity. (Fig. 11.)

Some time after Makdum (the Genealogy of Sulu says ten years) there came to Sulu a prince from Meningkabaw. This is a rich, high region in central Sumatra, from which many Malayan dynasties seem to have come. The first historic seat of Malay rule was Pagur Ruyong (in the mountains of Sumatra), the capital of the so-called empire of Meningkabaw.[1]

Five years after the arrival in Sulu of the Rajah Baginda, from this Sumatran region, the rajah of Juwa sent a messenger to Sulu with a present of wild elephants. We are informed that the messenger's name was Juya, that he

[1] Malay-English Dict., R. F. Wilkinson, III, 2.



MANY CHINESE CHARACTERS VISIBLE

This pony, photographed at Batangas, P. I., shows many of the traits which are found in the horses of China. It is learned from old records that the Spaniards, after they captured the Philippines, introduced many horses from China and Japan, which have helped to make the stock of the islands the complex mixture that it is today. (Fig. 12.)

died at Ansang, and that only two of the elephants survived in Sulu.[2] I mention these facts to demonstrate that the Rajah Baginda was a prince of some importance in Malaysia, and that there was communication between him and rajahs in the older region.

The next arrival on our scene is Abu Bakr, a learned Muhammadan jurist who is supposed to have been born in Mecca, and to have lived in Malacca and Johore for some time, proceding eventually to Sulu by way of Sumatra and Brunei. He founded in Sulu the dynasty which was reigning at the time of the arrival of the Spaniards, June, 1578.

Examining the information furnished by the early Spanish chroniclers,[3] we read: "Cinnamon, ginger, myrobalans,[4] oranges, lemons, cucumbers, gourds, chickens, geese, deer, elephants, horses and other things are found there."

The statement that horses existed in the Muhammadan islands of the Philippine archipelago is substantiated by the report of Don Esteban Roderiguez de Figuerosa to Governor Sande in June, 1578: "These Moros are most dangerous people, being familiar with all manner of firearms and with horses."

The foregoing evidence makes me feel confident that before the discovery of the islands by Europeans, the natives

[2] Ms. chronicle belonging to Hajji Butu, prime minister to the Sultan of Sulu.

[3] "First Voyage around the World," by Antonio Pigafetti (1519–1522).

[4] Probably the fruit of *Phyllanthus emblica* L. This Indian product enjoyed anciently a great reputation; modern pomologists who have eaten it consider it nearly worthless.

of Sulu and parts of Mindanao possessed horses, and I have shown that these animals might easily have been brought by powerful Malayan princes as early as the fourteenth century.

THE MALAY IMMIGRANTS

But as to the exact origin of the animals, we cannot say with certainty. The records of Sulu assert that even before the arrival of the rajah Baginda from Sumatra, the trade of Sulu extended to Japan and China on the one side, to Java and Molucca on the other. Large numbers of natives of Celebes are asserted to have migrated to Sulu and been assimilated by the people there. Furthermore, a large part of the Malayan region acknowledged the supremacy of the Mongol conqueror Kublai Khan, and some of his followers might have been responsible for bringing horses to the Philippines. Again, vast hordes of people from Johore are said to have migrated to Sulu early in the fourteenth century, and might easily have brought the animals with them.

Thus it will be seen that there are two possible sources from which the first horses might have come to the Philippines: Malaya, or China.

In favor of a Malayan origin is the fact that the bit used by the Moros is not only entirely different from that of the Spaniards, but is also dissimilar to any Chinese or Japanese bit which I have ever seen. Whether it is like those now used in Malaya, I am unable to say.

But it requires no strain of credulity for me to think it probable that horses were first brought to the Philippines from Sumatra, or one of the neighboring islands.

If we accept, as it seems to me we must, the idea that the Sulu horses are from some part of Malaya, it seems to me most probable that they came from the same place the Sulu people did—namely, Sumatra. It is possible that they have later had an infusion of blood from Celebes, or indeed from other sources.

Investigating the modern breeds of Sumatra and Celebes, we learn from Hans von Barnekow that there is a breed called the Balak, which in usefulness excels all others. Its home is the high plateau of Sumatra, especially the shores of the great Toba lake. In conformation it is handsomer than any other of the native breeds, and is as good under the saddle as for cultivating. All other horses of the western coast of Sumatra are known under the collective name of Bovenland, although they vary a good deal in build and value; they are heavier than the Balak but do not equal it in utility.

The Celebes horse is now generally called the Macassar and although small and not beautiful, is hardy and strong. Its owners have long been distinguished above all other residents of the Malayan region, for skill in horse breeding.

I am inclined to believe that the Sulu horse represents the Batak, with perhaps some intermixture of Macassar and Bovenland blood.

These horses of the Moros never seem to have become known in the northern Philippines. We must next consider the origin of the horses found in Luzon and other northern islands.

THE HORSES OF LUZON

The discovery of the Philippine archipelago by Magellan marks the opening of a new chapter in the history of the Philippine horse, which was no longer to be the exclusive possession of a few Muhammadan tribes in the extreme south.

It might have been supposed that the natives of Luzon and the Visayan islands would have received the horse from Chinese traders who constantly visited them. But we are assured by the Chinese historian Chua Juka that his countrymen only skirted the coasts of the islands, and had no direct communication with the interior of the islands. The Spaniards, however, considered the horse a necessity: an old manuscript relating to the expedition of Villalobos, which left Acapulco, Mexico, in 1530 to proceed to the Philippines, mentions the commander's order that those who take horses may take two Indian slaves apiece.

If any horses were taken, they must

AN IGORROT PONY

The natives of Benguet province have many ponies, but due to lack of care they have in many cases degenerated to scrubs. This photograph, taken at Trinidad, Benguet, shows the average native pony of the district. The position of the rider's foot in the stirrup is particularly striking to an American horseman. (Fig. 13.)

have perished, as Governor Sande's relation (1576) remarks that the governor on his walks always went afoot, "as there were no horses." From the same source we learn that in the year 1576 a Chinese called Omacon appeared off Pangasinan, being in command of a ship that was searching for a pirate named Limobon, whom he found there. He had the good luck to discover that the Spaniards had already met and defeated this pirate.

The captain had brought with him, as present or for trade, thirteen horses, which the Spanish chronicler describes unflatteringly—"These beasts are full of bad habits like those of Galicia."

The above fragmentary records are all I have been able to recover concerning introduction of horses during the first years of the Spaniard's possession of the islands. But the trade quickly took greater proportions. In 1583 the general junta at Manila made a

memorandum, "That the buffalo (carabao) be domesticated, and that his majesty should give imperative orders that an effort be made to have many cattle and horses brought from China and Japan."

A letter of Santiago de Vera to Philip II, dated June 26, 1587, states, "Many vessels have come to these islands from China this year, and especially to this city more than thirty of considerable burden, laden with a quantity of merchandise, horses, cows and more than 3,000 men." In the relation of events for the following year, 1588, we read, that many horses and cows have been brought from China to Manila.

That the effort of the colony to introduce and distribute horses met with the approval of the king, is evidenced by his instructions to Gen. Dasmarinas, dated August 9, 1589: "Cattle and horses are to be sent to the islands, and the farmers sent shall be ordered to tame and breed the wild buffalo found there."

These positive orders evidently bore fruit. As early as 1604 Cherino says, in his relation of events from 1601 to that date: "But they (Chinese) have stocked the islands with horses and mares which have since multiplied, and great stock farms have been established."

Production seems to have outrun demand, for Viana in his memorial of 1761 reports that although there are many horses in the islands, "there would be more if the ranchmen had a better sale for them. They are accustomed to kill them in order to dry their flesh and sell it."

To sum up, we find that as early as 1751 the horse had, through the activity of the Spaniards, become introduced and distributed in the northern islands; and that these horses were not from Spain, as has been ever since taken for granted, but that they were from China.

CHINESE HORSES

When we try to ascertain the ancestry of these Chinese horses, we meet with little success. It is known that they were domesticated in the Flowery Kingdom at a very early day: a hymn ascribed to the Yin dynasty (1766-1122 B. C.), describing the emperor's horses, mentions thirteen different colors. All black horses had to be turned over to the monarch.

In trunk and limbs the horses of Korea and Mongolia bear a close resemblance to that wild Siberian breed known as Prjevalsky's horse, and to the semi-wild Tarpan from the same region, and it may well be that the Chinese horses in general are of northern origin.

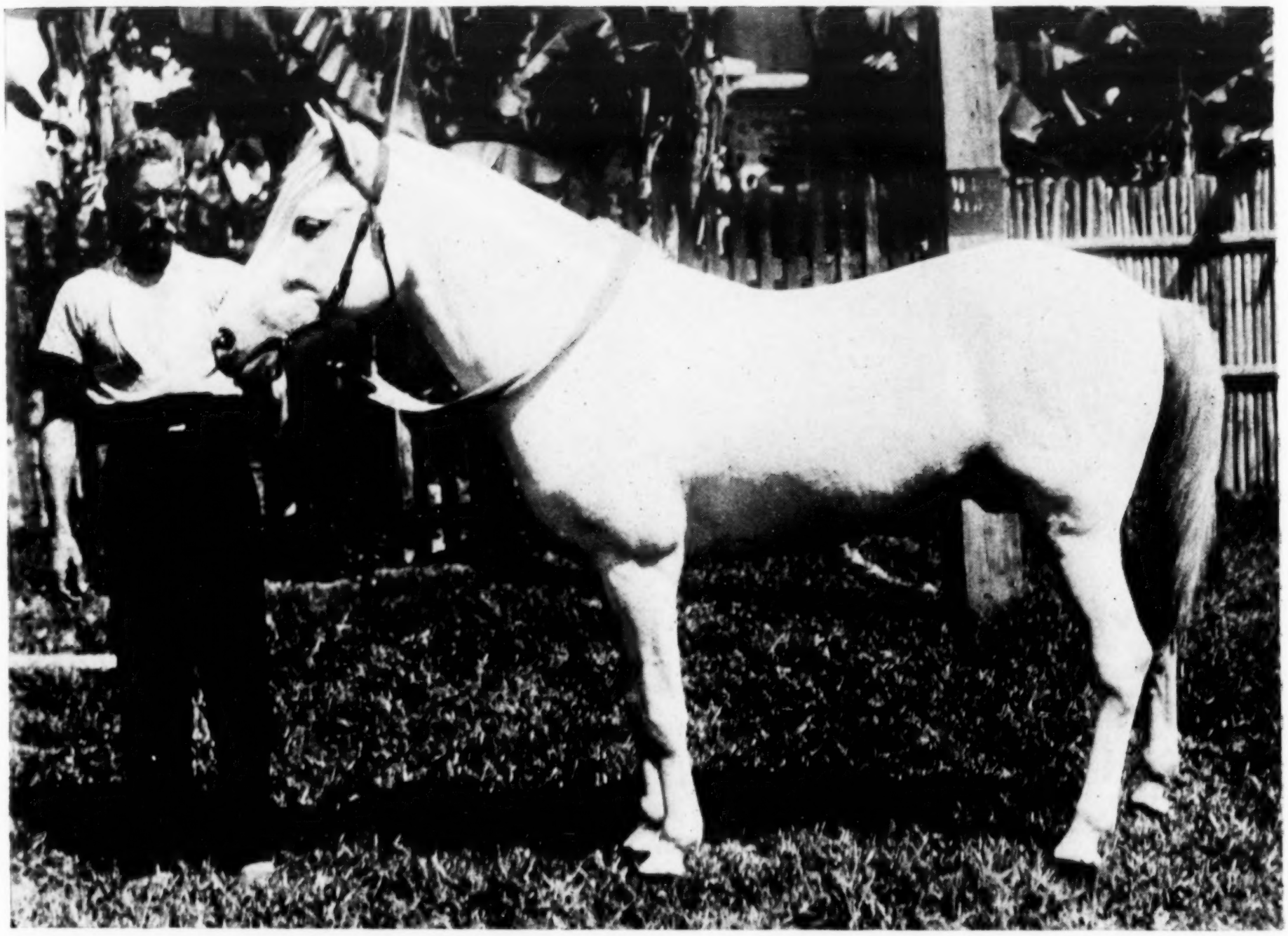
It is natural to suppose, and is demonstrated by such facts as we have, that the horses brought to the Philippines were from the southern provinces of China. Even today the resemblance between the breeds in these two regions is close. The Mongolian horses which I have seen are coarser than these south China horses and the still smaller Philippine ponies.

It will be recalled that the orders of King Philip II directed that horses be brought from Japan as well as China. The first record of importation from Japan is in a letter to the monarch from Santiago de Vera, dated June 26, 1587. "In a former letter," he writes, "I informed your majesty of the arrival of a Japanese vessel laden with flour and horses (which they are bringing to this city), at the town of Segovia in the province of Cagayan in these islands." This is the most northerly province of Luzon. "They had been driven ashore upon the coast there and some of the crew and horses escaped."

Again in a letter to the king from Governor Tello, dated June 17, 1598, we read, "After this the ambassador was invited to dine with the [ruler of Japan] three times and was finally dismissed with a present of twelve coats of mail, thirty lances and two horses."

The most lucid and concise description available relative to the trade in horses is that by Dr. Antonio de Morga, which follows:

"There were no horses, mares or asses in the islands until the Spaniards had them brought from China and Japan, and brought them from Nueva



THE PHILIPPINE HORSE AT ITS BEST

From the mongrel stock of the Philippines, representing breeds of all parts of the world, some good strains have been isolated, and when care is used, ponies can be produced which for local conditions are excellent. The horse shown above illustrates a good type produced in the Northern islands; although the animals are small, they are hardy and very capable. (Fig. 14.)

España (*i.e.*, America). Asses and mules are very rare, but there are many horses and mares. Some farms are well stocked with them, and those born there (mixed breeds for the most part) turn out well: they have good colors, are even tempered and willing to work, and are of medium size. Those brought from China are small, very strong, good goers, treacherous, quarrelsome, and bad tempered. Some horses of good colors are brought from Japan. They have long, well-shaped bodies, thick hair, large fetlocks, large legs and front hoofs, which makes them look like draft horses. Their heads are large and their mouths hard. They run slowly but walk well and are spirited and of much mettle."

From the above, I think we are justified in concluding that a considerable number of Japanese horses was brought to the Philippines, first and last. It may be worth while to try to fix the exact breed of these.

There are four recognized breeds of horses in Japan: the Hokkaido, Nambu, Miham and Satsuma. The description of the Nambu given by Sawamura Makoto[5] convinces me that the horses taken to the Philippines were of this blood. He says:

"The Nambu breed is easily distinguished by a thick, low neck and long, slender body. The croup is narrow, short and sloping, and not well developed. The legs are short and rather heavy while the articulation is somewhat weak, the hoofs being large and flat. Owing to the poorly devel-

[5] In the *Journal of the International Institute of Agriculture.*

oped muscles the gait is not very quick or light. The height is from 4 ft. 7 in. to 5 ft."

In a conversation about Japanese horses Professor Fujita, who formerly occupied the chair of zoology at the Imperial University of Tokyo, informed me that the Nambu is the best horse produced in Japan today, as well as one of the oldest and purest breeds, foreign blood not being desired by its owners.

In connection with this breed, I wish to call attention to the horses sometimes met with in our provinces of Cagayan, Isabela and Ilocos Norte. These individuals show in a marked degree the characters above-mentioned. I recall particularly a horse seen in Cagayan province in the year 1910, which one would have felt certain was a Japanese importation. Inquiry brought out the fact that not only he, but his sire and dam as well, had been born and raised in the town.

It would seem, from the information available, that the importation of horses from Mexico met with many obstacles. In his instructions to Dasmarinas (August 9, 1589), Philip II advised him that he was writing the governor of Nueva España to send to the Philippines twelve mares, two stallions, twenty-four cows and two bulls, and Dasmarinas was requested to take these with him. On May 25, 1596, Governor Tello was advised by the king of a similar order to the viceroy of Nueva España, but in the following year the governor reported that the animals had not been received. The first actual evidence I have found of the presence of Mexican or Spanish horses in the Philippines is the letter of Fray Gregorio de la Cruz regarding an expedition to Camboja (now French Indo-China). Under date of August 1, 1595, he acknowledges receipt of a Castilian horse which together with some hunting dogs and emeralds was being sent to the king of Siam as a present. Aside from one or two hints of this sort, there is no record of the introduction of horses from Mexico during the first century of the Philippines, and it is my belief that not until later were they introduced in such numbers as to exert much influence on the industry in the islands.

The ancestry of any horses brought from Mexico can be confidently traced to the horses brought there from Spain by Cortez, Coronado, and other early explorers; for it is well known that the horse did not exist in the New World prior to the arrival of Columbus.

SPANISH HORSES

The original horses brought to Mexico were certainly not, as most people suppose, of almost pure Arab or Barb stock. The Spanish horse of the fifteenth century had been subjected to a long process of cross-breeding. Because of the weight of both armor and rider, the Spaniards had felt the necessity for a heavier horse than either the Arab or the Barb, and therefore introduced German blood.

The story of this cross and its effects may be graphically studied in the museum of paintings at Madrid, in the paintings of Rizzi, Bartolme, Gonzales, Paret, Goya and others. Horses in the later paintings, such as those of the Duke of Zaragosa and Charles IV, have oval heads like those of sheep, while as early as the middle of the fifteenth century the type of the Andalusian was that of a Germanic race. This process was probably largely influenced by Charles I, himself a German.

Thus it is evident that the Spanish horse had lost much of its Arab or Barb blood before introduction to America. Just what blood had entered is not known; but as most of the large West European races contain a greater or less degree of Norse blood, there is ground for assumption that whatever race was utilized contained some of that blood. Norse horses were mostly dun colored with black points. The mane is long and heavy and falls to both sides with a longitudinal dark band connecting the mane and tail. Distinct dark bars are also present, especially in the region of the knees and hocks. The ears are short and carried in an upright position. The outline of the face becomes convex

near the muzzle and ends in a rather long upper lip.[6]

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Reviewing the horses I myself have seen in the various provinces, I find five fairly well defined types, not counting the various half-breeds and mestizos or scrubs. It should be said that there is almost every possible gradation between these types. Nevertheless, the types are distinct—anatomically, and not by geographical lines. They are:

1. A type which favors the Arab in many points. The head is sharply chiseled, though not dished as in the Arab; eyes large and lustrous; ears well placed, normal and mobile; head well attached, neck rather thick, well curved and graceful. Chest as a rule full and well developed, though sometimes narrow. Withers full, hindquarters developed to a sufficient extent, tail gracefully placed and carried with vigor. Croup regular and compact. The rump, withers and hindquarters are remarkably strong. Both fore and hind legs are clean-cut, free and muscular, with good articulations. The hoofs are generally oval, black and hard, though there is sometimes a tendency to mule-foot. Mane and tail full. It is needless to say that individuals of this type have been produced by more or less careful breeding and are therefore most plentiful in the provinces that have been longest settled.

2. A type that favors the Chinese horse. Individuals are generally rather short (49 or 50 inches) but thick-set. Head heavy though not noticeably long, nose flat, nostrils rather full, lower jaw powerful, forehead and face rather narrow, profile more convex toward the muzzle, ending in a somewhat long upper lip. In neck, shoulders and trunk they resemble a small cart horse. Hindquarters are full and rounded and tail well placed, although there is slightly more slope to the croup than we generally desire. Hind legs are fairly long with hocks close together, often cow-hocked, hoofs vary but generally oval, black and hard, though sometimes narrow. Mane heavy and full, falling on both sides; tail long and full.

3. In the third type are most of the horses of the islands, particularly in the rural districts. They vary around 48 or 50 inches high, with medium head, well chiseled and placed, profile straight, neck gracefully curved, chest rather

[6] J. Cossar Ewart, "Multiple Origin of Horses and Ponies."

oped muscles the gait is not very quick or light. The height is from 4 ft. 7 in. to 5 ft."

In a conversation about Japanese horses Professor Fujita, who formerly occupied the chair of zoology at the Imperial University of Tokyo, informed me that the Nambu is the best horse produced in Japan today, as well as one of the oldest and purest breeds, foreign blood not being desired by its owners.

In connection with this breed, I wish to call attention to the horses sometimes met with in our provinces of Cagayan, Isabela and Ilocos Norte. These individuals show in a marked degree the characters above-mentioned. I recall particularly a horse seen in Cagayan province in the year 1910, which one would have felt certain was a Japanese importation. Inquiry brought out the fact that not only he, but his sire and dam as well, had been born and raised in the town.

It would seem, from the information available, that the importation of horses from Mexico met with many obstacles. In his instructions to Dasmarinas (August 9, 1589), Philip II advised him that he was writing the governor of Nueva España to send to the Philippines twelve mares, two stallions, twenty-four cows and two bulls, and Dasmarinas was requested to take these with him. On May 25, 1596, Governor Tello was advised by the king of a similar order to the viceroy of Nueva España, but in the following year the governor reported that the animals had not been received. The first actual evidence I have found of the presence of Mexican or Spanish horses in the Philippines is the letter of Fray Gregorio de la Cruz regarding an expedition to Camboja (now French Indo-China). Under date of August 1, 1595, he acknowledges receipt of a Castilian horse which together with some hunting dogs and emeralds was being sent to the king of Siam as a present. Aside from one or two hints of this sort, there is no record of the introduction of horses from Mexico during the first century of the Philippines, and it is my belief that not until later were they introduced in such numbers as to exert much influence on the industry in the islands.

The ancestry of any horses brought from Mexico can be confidently traced to the horses brought there from Spain by Cortez, Coronado, and other early explorers; for it is well known that the horse did not exist in the New World prior to the arrival of Columbus.

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narrow, croup sloping, legs clean-cut, hoofs oval, black and hard, articulations good. Tendency to cow-hock. Mane and tail not very full, although the prevalent custom of roaching the mane and clipping the tail makes it hard to decide.

4. Another type, found mostly among the non-Christian tribes, is a small, stunted animal, the result of promiscuous breeding, poor food and little care. These animals seldom stand over 4 feet high—many will come within 45 or 46 inches. They are mostly dun colored, rough coated; face narrow and sometimes inclined to that configuration which is called hatchet-face. They are inclined to be ewe-necked; chest narrow and weak, croup narrow and often sloping, hindquarters weak, rather cut legged and cow-hocked. Mane is short and bushy, having the appearance of being roached even when it is not; tail similar. The only redeeming feature in these horses is their hardiness and ability to exist on mountain grasses and other non-nutritious roughage throughout the year.

5. The fifth type, not often seen, resembles the Nambu breed of Japan. The head is heavy and long with straight profile, neck straight, body long and slim, withers prominent, croup narrow and sloping, legs heavy with well-developed fetlock, front hoofs quite large and round, mane full and falling on both sides, tail full and long.

The horses of Sulu and part of Mindanao might be considered to be a still different type, having, as I showed, a distinct ancestry. Their heads are broad with forehead inclined to be bumpy, ears rather long and set obliquely on the head, eyes large and far apart, neck thick, chest and shoulders well developed, withers strong but not prominent; profile straight, almost dished; muzzle square with large nostrils, body moderately long, croup sloping but not narrow. Hocks well placed together but not cow-hocked; legs rather short, hoofs oval, well-formed and hard.

In color there is every possible variation, throughout the islands, but buckskin largely preponderates. There follow, in order, the bay, gray, piebald, black, and a good many albinos. In a census taken by the writer on one island, Catanduanes, where there are more than 3,000 horses, between 55 and 60% of the horses were of the various shades of dun, varying from fallow to mouse.

CONCLUSION

In conclusion, I have endeavored to prove that the Philippine horse is not, as popularly supposed, a descendant of horses brought to the islands from Mexico and Spain by the Spanish, but that the bulk of the animals brought in by the early colonists were Chinese. I have also shown that horses existed in parts of the archipelago prior to the Spanish conquest, and I have endeavored to trace the ancestry of these to Malaya. I have pointed out that, in addition to China, other channels hitherto almost unknown have poured equine blood into the Philippines; so that the horses of the islands today contain large or small amounts of characters from the Chinese, Japanese, Mexican (including various races entering into the race so designated), Persian, Indian, Sumatran breeds.

The data furnished have been obtained from the following sources:

The Philippine Islands, by Blair and Robertson; a translation of the manuscript of the Archives of the Indies, at Madrid.

History of Sulu, by M. M. Saleeby; based on original MS. (known as the *Luntar*) obtained from the Sultan of Sulu, and the Genealogy (*Tarsila*) of Sulu, obtained from Hajji Butu, prime minister to the present sultan.

Archives of the executive bureau, Manila.

I am particularly indebted to Dr. Saleeby for information personally furnished.

New Oat Varieties for Maine

After five years of selection, the Maine State Agricultural Experiment Station has isolated twelve pure lines of oats which it considers particularly valuable for local conditions. They are described in Bulletin 250 (May, 1916), the introduction to which gives an interesting account of "pure lines" and the general principles governing cereal breeding in the light of genetics.

RASPBERRY BREEDING IN NEW YORK

THE breeding of raspberries at the Geneva, New York, state agricultural experient station was begun nearly a quarter of a century ago. At first the work was largely confined to the red raspberry and a number of excellent seedlings were secured from various combinations of Marlboro, Loudoun and Superlative. Since 1910, greater attention was paid to the black-cap and purple raspberries. About 3,300 seedlings were tested.

It was to set at rest any doubts which might remain as to the hybrid origin of the purple raspberry, Peck's *Rubus neglectus*, and to secure better varieties of this popular sort, that the breeding of purple raspberries was undertaken. The work has shown beyond a doubt that these originated as hybrids of the black-cap and red raspberry. Some very promising seedlings have been secured.

Pure seedlings of Columbian and F_1 hybrid, failed to break up as much as would be expected. None showed any tendency to propagate by suckers nor did any have fruit of the color of either parent. In cane color and glaucousness some of the seedlings more nearly approached the parent types.

Hybrid seedlings were produced by crossing two black-caps with a red raspberry. With one cross the seedlings were all purple; among the 289 seedlings of the other cross were ten yellows. None progated by suckers.

A study of the inheritance of color of fruit would indicate that several of our black raspberries are heterozygous for color and that probably several color factors are present. The same thing holds with the red raspberry though the higher number of yellows would indicate fewer color factors. Selfed seedlings of Columbian gave one yellow, one black and forty that were probably varying degrees of purple. A black-cap which was pure for color produced only purples when crossed with a red containing a factor for yellow, but when both were heterozygous yellow hybrids were produced.

Glaucousness, the presence of bloom on the canes, is probably a dominant character. Both the Columbian seedlings and the F_1 hybrids gave glaucous and non-glaucous bushes in a ratio very nearly three to one.

The F_1 hybrids could also be separated in the ratio of three with rough bark to one with smooth bark.

Three of the Columbian seedlings produced some unusual abnormalities in the flower clusters. There were many gradations from perfect fruits to those in which the drupelets were replaced by small, sepal-like leaves. In other clusters the fruits varied from perfect to entirely sterile forms which did not have the leafy growth.

All the purple raspberries having Smith No. 1 as the female parent were standard plants but nearly one-third of the Cumberland seedlings were dwarfs. The factor for dwarfing is evidently one of rather rare occurrence.

From a correlation which was found between leaf coloration and fruit it would seem that it is entirely possible to tell all yellow raspberries from either the red or purple sorts by the absence of any tinge of red on the leaves. It is probably true also that the bark of the young canes of the yellow varieties is entirely lacking in any touch of red or purple color.

The Herbert red raspberry and the Blowers blackberry were pollinated by the flowering raspberry, *Rubus odoratus*. The Blowers seedlings were lacking in vigor and all died the first year. The Herbert seedlings made a strong growth and in 1915 blossomed freely. A study of these leaves no doubt as to their hybrid origin. In *Rubus odoratus* we may have a go-between through which we may mix the blood of several of our species. This work of hybridization will be continued with many other species, of which there are now nearly fifty growing on the station grounds. —Summary of Bul. No. 417, "Some Notes on the Breeding of Raspberries," by R. D. Anthony, under the direction of U. P. Hedrick, March, 1916.

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Vol. II, Nos. 3 and 4.
Vol. III, No. 2.
Vol. IV, Nos. 1 and 4.

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Vol. VI, Nos. 2, 3, 4, 5, 7, 9, 11 and 12.

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THE AMERICAN GENETIC ASSOCIATION

is an incorporated organization, co-operative in nature and devoted to promoting knowledge of the laws of heredity in the broadest sense of the word, and their application to the improvement of plants, animals, and human racial stocks. It is the largest organization in the world for the advancement of genetics, and its organ, The Journal of Heredity, is the most important agent for furthering the interchange of ideas between investigators of different phases of these problems, and for the presentation of their results to the public.

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